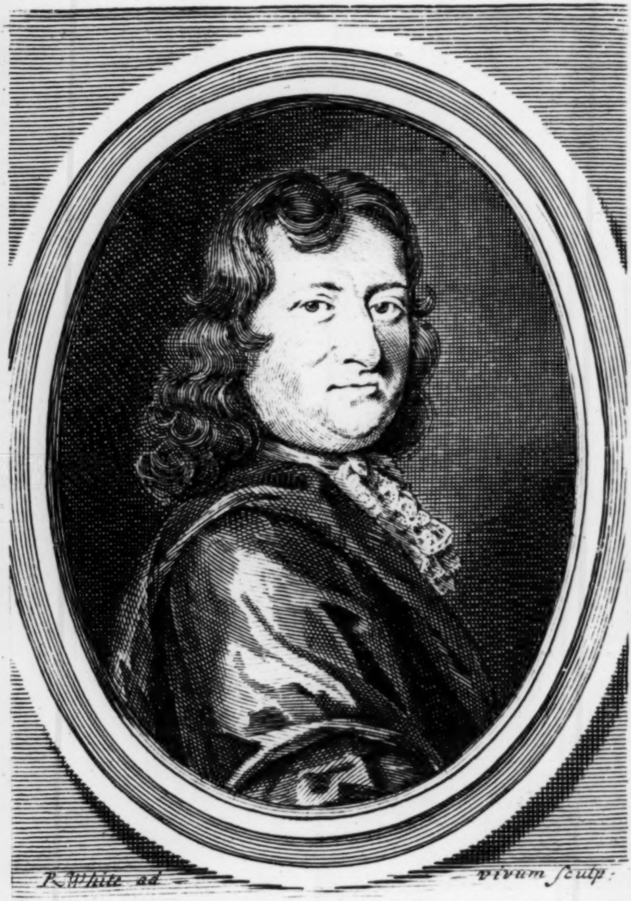

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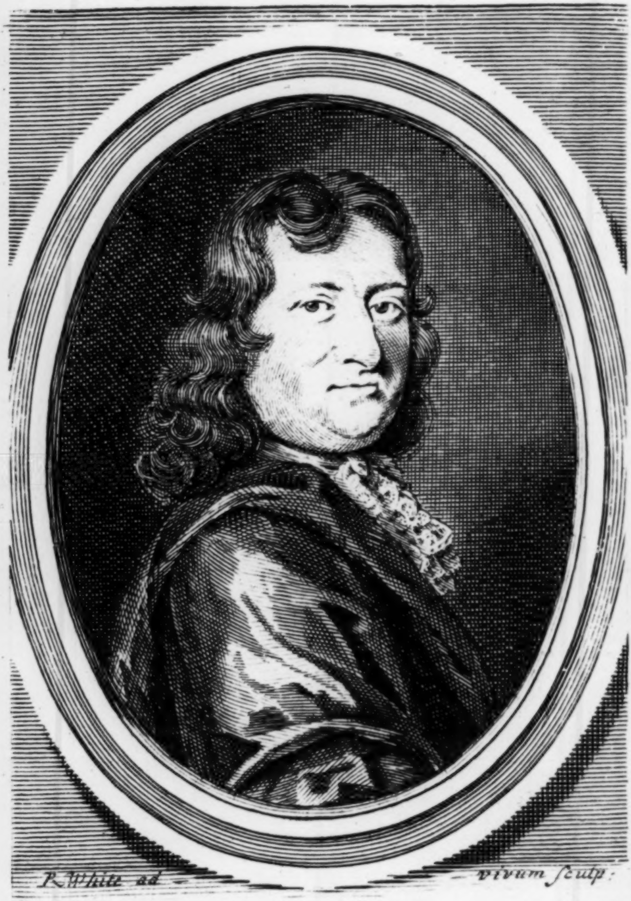

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Arithmetick:

A

TREATISE

Designed for the Use and Benefit of

TRADES-MEN.

WHEREIN

The NATURE and USE of *FRACTIONS*, both *Vulgar* and *Decimal*, are Taught by a New and Easie Method.

AS ALSO,

The Mensuration of *SOLIDS* and SUPERFICIES.

The Second Edition, very much Corrected and Enlarged.

By *J. AYRES*, at the *Hand* and *Pen* in St. *Paul*'s Church-yard.

London: Printed for *Sam. Crouch*, at the corner of *Pope's-Head-Alley* next *Cornhil*: And *J. Blare*, at the *Looking-Glaß* on *London-Bridge*. 1695.

To the Right Honourable,

Sir *William Ashhurst*, Kt.

LORD MAYOR

OF THE

City of *LONDON*.

This Manual of

Practical Arithmetick

IS

HUMBLY DEDICATED

AND PRESENTED

BY

Your Lordship's

Most Obliged

Humble Servant,

John Ayres.

THE PREFACE.

THIS *Manual of Practical Arithmetick, adapted chiefly for the* Benefit *and* Use *of* Tradesmen, *is the Product of some vacant Hours. A Work for its Nature and Kind differing from any thing heretofore published that I know of: All the Rules being made plain and easie to the meanest Capacities, for whose sakes it is principally intended; which is the Reason so much of the Book is taken up in* Explaining *and Teaching the Groundwork,* viz. *Addition, Subtraction, Multiplication, and Division, which most Arithmetick Books are deficient in; a Defect in any of those Rules will render the Labours of such as learn Arithmetick by Books, very difficult and hard. To help which, I have first of all laid down the* plainest way of Division *for a Learner that wants the help of a Master, and afterwards have given the* shortest Italian way of Division. *I have also omitted several Rules that*

are not of Use in Trade, such as Allegation, Barter, Loss and Gain, Company with Time, *&c. And have supplied those Omissions with what is more Useful and Practical,* viz. *Great Enlargements and Variety of the Golden Rule of Three, The Rule of Three Inverse, Double Rule of Three, and the use of the Compound Rule of* Five Numbers *in working Interest; Rules of Practice with great variety, and* short ways *to Cast up Merchandize, The Order of Deducting Tare and Tret, with other Rules useful in Trade. Lastly, I have made* Fractions *very Easie and Familiar (though differing from any former Method) having mixed both* Vulgar *and* Decimal Fractions *together under the same Head, that the Ingenious may discover the Ease as well as Excellency and Brevity of the* Decimal *beyond the* Vulgar Fraction. *And as my Paper would admit, have added some Variety of Measuring Superficies and Solids.*

J. A.

CHAP.

CHAP. I.

Of NUMERATION.

I. A*RITHMETICK* is the Art of Numbring well, or of Accompting well by Numbers: For as Magnitude or Greatneſs is the Subject of *Geometry*, ſo is Multitude or Number the Subject of *Arithmetick.*

II. The whole Art of *Arithmetick* depends upon the true knowledge of the five following Rules, viz. *Numeration*, *Addition*, *Subtraction*, *Multiplication*, and *Diviſion*. All the other Rules being Compounded of theſe, we ſhall treat particularly of them in their order.

III. *NUMERATION, Teacheth to expreſs or write down the value of any Number whatſoever propoſed.*

IV. All Numbers are written with ten Characters called Figures, of which the laſt is called a Cypher, and of it ſelf ſignifieth

nothing, but ſerveth (according as it is placed) to increaſe or diminiſh the value of another figure to which it is either annexed, or prefixed.

V. The Ten Characters or Figures by which all Numbers are expreſſed, are thus written, *viz.* 1, one; 2, two; 3, three; 4, four; 5, five; 6, ſix; 7, ſeven; 8, eight; 9, nine; 0, Cypher: The Nine firſt of theſe are called ſignificant Figures.

VI. All Numbers are either Simple, or Compound.

1. A Number is ſaid to be Simple when it conſiſteth but of one Figure, as 4, and 8, 6, *&c.* are ſimple or ſingle Numbers.

2. A Number is ſaid to be a Compound Number when it is compoſed of two, three, four, or more figures; ſuch as are 35, 356, and 7428, *&c.*

VII. Every ſignificant figure hath a double value, *viz.* Certain or uncertain.

1. The value of a figure may be ſaid to be certain, when it ſignifieth ſimply its own proper value, without the addition of any other word for its explanation, and ſo 4 ſignifieth four, 8 ſignifieth eight, and 9 is nine, *&c.*

2. The value of a figure may be ſaid to be uncertain, in reſpect of the place it may ſtand

ſtand in, and ſo 4 may ſignifie forty, or four hundred, or four thouſand, &c. and 8 may ſignifie eighty, or eight hundred, or eight thouſand, &c.

VIII. When a Number is compoſed of divers figures ſet together like the Letters in a word, that Number is ſaid to conſiſt of as many places as there are figures uſed in the compoſing thereof. So the Number 4643 is ſaid to conſiſt of four places, becauſe it is compoſed of four figures; the like is to be underſtood of any other.

IX. The places in every compound number are to be conſidered both as to their order, and their value.

1. The Order of the places is from the right hand to the left, the firſt Figure or Cypher towards the right hand is ſaid to poſſeſs the firſt place, and the next towards the left hand, is ſaid to poſſeſs the ſecond place, and the next to that the third place, &c.

So if this Number were propoſed, *viz.* 5734, here 4 is ſaid to poſſeſs the firſt, 3 the ſecond, 7 the third, and 5 the fourth place, &c.

2. The value of every figure is diſcovered by the place that it ſtands in; *viz.* The firſt place is the place of *Unites*, or ones; and the figure that ſtandeth in that place ſignifieth

its own proper, or ſimple value. The ſecond place is the place of *Tens*, and the figure that ſtandeth there ſignifieth as many *Tens* as the figure it ſelf containeth *Unites*: As if it be 4, it ſignifieth four *tens*, or forty; if it be 7, it ſignifieth ſeven *tens*, or ſeventy, *&c.* The third place is the place of *Hundreds*; and the figure that ſtandeth there is as many *hundreds* as it containeth *Unites*: So 5 in the third place is five hundred, and 6 ſignifieth ſix hundred, *&c.* The fourth place is the place of *Thouſands*, and the figure that ſtandeth therein ſignifieth as many *thouſands* as it contains *Unites*; ſo 8 in the fourth place is eight thouſand, and 4 is four thouſand, *&c.* As,

Suppoſe this Number, *viz.* 4652, were given to have its value expreſſed; The figure 2 (in the firſt place) is two *unites*, or ſimply *two*; the figure 5 (in the ſecond place) is five *tens*, or fifty; ſo 52 is thus expreſſed, *viz. fifty two*: The figure 6 (in the third place) is ſix hundred, ſo 652 is thus expreſſed, *viz. ſix hundred fifty two*; the figure 4 (in the fourth place) is *four thouſand*, ſo 4652 is thus to be read, *viz. Four thouſand ſix hundred fifty two.*

In like manner if any figure hath a *Cypher*, or *Cyphers* annexed to it, it ſhall ſtill retain the

the value of its place, as much as if a ſignificant figure, or figures, were annexed to it in the room of the *Cypher* or *Cyphers*; ſo if to the figure 6, there be a *Cypher* annexed thus (60) its value is *ſix tens*, or *ſixty*, becauſe it ſtandeth in the ſecond place, or place of *Tens*. Likewiſe if it have two *Cyphers* annexed to it thus (600), its value is *ſix hundred*, becauſe it poſſeſſeth the third place, or place of *Hundreds*. Alſo 6000 is *ſix thouſand*, becauſe 6 ſtandeth in the fourth place, or place of *Thouſands*.

And the value of any figure increaſeth in a *Decuple* proportion from the right hand to the left, every place being *ten times* the value of the former, as you may ſee in the following Table.

NUMERATION TABLE.

Hundreds of Millions	*Tens of Millions*	*Millions*	*Hundreds of Thousands*	*Tens of Thousands*	*Thousands*	*Hundreds*	*Tens*	*Unites*	*The Numbers in the Table are thus to be Read*, viz.
9	8	7	6	5	4	3	2	1	987 Mil. 654 Th. 321
1	2	3	4	5	6	7	8	9	123 Mil. 456 Th. 789
	2	3	4	5	6	7	8	9	--23 Mil. 456 Th. 789
		3	4	5	6	7	8	9	—3 Mil. 456 Th. 789
			4	5	6	7	8	9	————456 Th. 789
				5	6	7	8	9	————56 Th. 789
					6	7	8	9	—————6 Th. 789
						7	8	9	——————789
							8	9	——————89
								9	——————9

Over-againſt every place of the Numbers in the foregoing Table is written (in words at length) the value thereof; *viz. Unites*, *Tens*, *Hundreds*, *Thouſands*, &c. which words being perfectly gotten by heart, and well underſtood, the Learner will be thereby enabled to expreſs or write down the value of any Number propoſed. And

And on the right hand of the Table over againſt every Number therein contained, you have direction how to read, or expreſs thoſe Numbers: As, 987654321 is thus to be read, *viz. Nine hundred eighty ſeven Millions, ſix hundred fifty four thouſand, three hundred twenty one.* And the like is to be underſtood of the reſt.

Although the foregoing Table be made to conſiſt but of Nine places, yet it may be continued to more places at pleaſure, even *ad infinitum*, obſerving that the value of every place is ten times as much as that which goeth before it; ſo the tenth place is *thouſands of Millions*, the eleventh place is *tens of thouſands of Millions*, the the twelfth place is *hundreds of thouſands of Millions*, and the thirteenth place is *Millions of Millions*, &c. *Note.*

There is yet another Method uſed by ſome that is very plain and uſeful in the expreſſing of great Numbers, or Numbers conſiſting of many places, which is this, *viz.* make a point after every third figure, beginning at the right hand, as in the following Example.

Let this Number be propoſed conſiſting of fourteen places, *viz.* 84639042724536, and when every third figure is pointed it will be thus, *viz.* 84.639.042.724.536, every

three figures being called a period, and are reckoned in order from the right hand towards the left, *viz.* 536 is the firſt Period, 724 is the ſecond Period, 042 the third, *&c.* the firſt period (which is 536) conſiſteth of *units, tens,* and *hundreds,* and is thus expreſſed, *viz. five hundred thirty ſix,* and every other Period is to be read in every reſpect as if it ſtood in the place of the firſt Period, only in expreſſing the value of the ſecond period, you muſt add thereto the word *thouſand*; to the third period you muſt add the word *Millions*; to the fourth period the word *thouſands*; to the fifth period *Millions of Millions,* and ſo the Number before propoſed is to be read as followeth, *viz.*

Mil. of Mil.	*Thouſand*	*Millions*	*Thouſands*	
84.	639.	042.	724.	536

Eighty four *Millions of Millions,* ſix hundred thirty nine *Thouſand,* forty two *Millions,* ſeven hundred twenty four *Thouſands,* five hundred thirty ſix.

CHAP.

CHAP. II.

Of ADDITION.

I. ADDITION *Teacheth to add, or put together divers Numbers, and to bring them to one total Sum.* As if 7 and 9 were given to be added together, their ſum will be 16; and the ſum of 5 and 4 is 9.

II. Numbers to be added together each of them conſiſt either of one denomination, or of divers, as if it were required to add 16 *l.* to 14 *l.* here both the given Numbers are of one Denomination, being Pounds only, without Shillings, Pence or Farthings: But if it were required to add 36 *l.*--14 *s.*--08 *d.* to 16 *l.*--12 *s.*--06 *d.* theſe conſiſt of divers denominations, *viz.* of Pounds, Shillings and Pence.

III. When it is required to add together ſeveral Numbers of one denomination, they muſt (in order to the work) be diſpoſed of according to the following

Rule.

Let the given Numbers be placed the one under the other in ſuch order that units may ſtand under units, tens under tens, hundreds under hundreds, thouſands under thouſands, &c.

Example.

Let it be required to add 136 and 42 together, they must be placed one under the other as followeth, *viz.*

Thus,	Or Thus,
136	42
42	136

IV. Having placed the given Numbers as before is directed, then draw a streight line under them, and (beginning at the place of units) add all the figures together that stand over one another in that Rank, putting their Sum under the said streight line; As in this Example I say, 2 and 6 is 8, wherefore I put 8 under the line, in its proper place, *viz.* under 2 and 6, and proceed to the next Rank which is the place of Tens, saying, 4 and 3 is 7, wherefore I put 7 in its proper place under the line; and proceed to the next and last Rank, where I find only 1, wherefore I put 1 in its proper place under the line, and so the work is finished, and I find thereby that the Total Sum of 136 and 42 to be 178; See the Operation as followeth.

136	42
42	136
178	178

V. If

V. If in adding together any of the Ranks (as is before directed) their Sum amounts to, or exceedeth 10, or any number of tens, then in ſuch caſe you are either to ſet down a Cypher under the line in its proper place, or elſe the exceſs above the ten or tens; and for every ten carry an unit to be added to the next Rank of figures. As if it amount to 30, then ſet down (0) a Cypher, and carry 3 (for the three tens) to be added to the next Rank; if it amount to 34, then ſet down 4 under the Rank that you added, and carry 3 to the next, *&c.* And when you have caſt up the laſt Rank or Series towards the left hand, ſet down the total that it amounteth to, as in the following Examples.

	(1)	(2)	(3)	(4)
	748	4758	1648	20864
	364	6473	3472	78987
	296	2894	1865	6217
	242	1862	3479	4320
Sum	1650	15987	10464	110388

In the firſt of theſe Examples I begin, ſaying, 2 and 6 is 8, and 4 is 12, and 8 makes 20, which is juſt 2 tens; wherefore I put down 0 under the line, and carry 2 to the next

next Rank for the 2 Tens, and proceed, saying, 2 that I carry and 4 is 6, and 9 is 15, and 6 is 21, and 4 is 25, which is 5 above 20, wherefore I put down 5 under the line, and carry 2 for the two Tens to the next Rank, and then proceed, saying, 2 that I carry and 2 is 4, and 2 is 6, and 3 is 9, and 7 makes 16, wherefore (because it is the last Rank) I put down 16 under the line, and so the work is finished, the total Sum of that Addition being 1650: The same is to be observed in the rest of the Examples.

VI. *Addition of divers Denominations* cannot be well performed until you know the value of common Coins, Weights, and Measures, *&c.* As how many Pence make 1 Shilling, how many Shillings make 1 Pound, And how many Ounces make 1 Pound, how many Pound make a Quarter of a C. and how many Quarters make a C weight.

In Addition of English Money, it is necessary first of all to understand the meaning and signification of the Characters superscribed over every Sum, as *li. s. d.*

Note, That *li.* signifies Libra, a *Pound*, not here in respect of common Weight, but *Money*, and for definition is called a *Pound Sterling.* So *s.* stands for Solidus (a Coin of Brass) used by the *Romans*, but with

with us of Silver, and signifies a *Shilling*; twenty of these Pieces make *one Pound Sterling*.

de. or *d.* stands for **Denarius**, a *Penny*, which contained ten Pieces of the *Romans* least Coin: It hath had a various Estimate in our *English Coins*. It now signifies a Penny, the 12*th*. part of a Shilling, or 12 of which make a Shilling. For until the Reign of *Henry* VI. a Penny was the 20 part of an Ounce of Silver, and in his Reign made the 30. By *Edw*. IV. 40 Pence made an Ounce. By *Hen.* VIII. there was allowed 45 *d.* to the Ounce. And by Q. *Elizabeth* an Ounce of Silver was divided into 60 parts, called Pence, as it is at this day.

Addition of Money.

Note, 4 *Farthings is a Penny,* 12 *Pence a Shilling, and* 20 *Shillings a Pound* Sterling, *or* English *Money.*

The following Table ought to be learn'd by heart.

12 times	1 is --	12	*d.*		*s.*	*d.*
	2 ——	24	20 is --		1	8
	3 ——	36	30 ——		2	6
	4 ——	48	40 ——		3	4
	5 ——	60	50 ——		4	2
	6 ——	72	60 ——		5	0
	7 ——	84	70 ——		5	10
	8 ——	96	80 ——		6	8
	9 ——	108	90 ——		7	6
	10 ——	120	100 ——		8	4
	11 ——	132	110 ——		9	2
	12 ——	144	120 ——		10	0

VII. When it is required to add together Numbers consisting of divers Denominations, you are to place the given Numbers in such order one under the other, that each Rank may consist of one and the same denomination. That is to say, if it be in Money, Let Pounds be set under Pounds, Shillings under Shillings, Pence under Pence, and Farthings under Farthings. The like is to be understood of *Weight*, *Measure*, *Time*, &c.

Then (having first drawn a Line under them) add them together, considering how many of each smaller denomination make an unite of the next that is superiour to it, (always observing to begin at the least denomination)

mination) and for every ſuch unite carry 1 to the next ſuperiour denomination, *viz.* If it be in Addition of Money, for every 4 in the Farthings you muſt carry 1 to the Pence (becauſe 4 Farthings is a Peny); For every 12 in the Pence, carry 1 to the Shillings (becauſe 12 Pence is a Shilling); and for every 20 contained in the Shillings, carry 1 to the Pounds (becauſe 20 Shillings is a Pound); And the odd Farthings, Pence, and Shillings ſet down in their proper Ranks under the Line, as in the following Example.

Some do indeed make a place of *Farthings*, and ſet a *q.* over them for *quartillier*, which is not very proper, and ſeldom uſed by Men of Buſineſs; therefore when you would write down three Farthings, or a Half Penny, or a Farthing, write it thus:

Three Farthings —— $\frac{3}{4}$
A Half Penny —— $\frac{1}{2}$
A Farthing —— $\frac{1}{4}$

Let it be required to add together 134 *l.* 16 *s.*—08 *d.*—$\frac{1}{4}$. and 286 *l.*—10 *s.*—04 *d.*—$\frac{3}{4}$. and 498 *l.* — 13 *s.*— 06 *d.* —$\frac{1}{2}$. and 794 *l.* 18 *s.*—09 *d.*—$\frac{1}{4}$. Then in order to the work I ſet them down, and draw a line under them, as followeth.

lb.	s.	d.	
134—	16—	08—	$\frac{1}{4}$
286—	10—	04—	$\frac{3}{4}$
498—	13—	06—	$\frac{1}{2}$
794—	18—	9—	$\frac{1}{4}$

Firſt, I begin with the leaſt denomination, which is that of Farthings, and add them together, ſaying, $\frac{1}{4}$ and $\frac{1}{2}$ is $\frac{3}{4}$, and $\frac{3}{4}$ is 6, and $\frac{1}{4}$ is 7 Farthings, which is 1 Penny and 3 Farthings, wherefore I put 3 Farthings under the Line, and under the Denomination of Farthings, and carry 1 (for the Penny) to to the next denomination of Pence, ſaying, 1 that I carry and 9 is 10, and 6 is 16, and 4 is 20, and 8 is 28, now 28 Pence is 2 Shillings 4 Pence, wherefore I put 4 under the line, and carry 2 Shillings to the denomination of ſhillings, ſaying, 2 that I carry and 18 is 20, and 13 is 33, and 10 is 43, and 16 is 59 ſhillings, which is 2 Pounds 19 ſhillings, wherefore I put the 19 ſhillings under the line, and under the denomination of ſhillings, and carry 2 (for the 2 Pounds) to the denomination of Pounds, and proceed, ſaying, 2 that I carry and 4 is 6, and 8 is 14, and 6 is 20, and 4 makes 24, wherefore I put down 4 under the line, and carry 2 for the

the two tens to the next Rank, ſaying, 2 that I carry and 9 is 11, and 9 is 20, and 8 is 28, and 3 is 31, which is 1 above 30, wherefore I put 1 under the line, and carry 3 (for the three tens) to the next Rank, and proceed, ſaying, 3 that I carry and 7 is 10, and 4 is 14, and 2 is 16, and 1 is 17, wherefore I put 17 under the line, becauſe it is the Sum of the laſt Rank, and ſo the whole work is finiſhed, and I find the Sum of the given Numbers to be 1714 *l.*—19 *s.*—04 *d.*—03 *q.* as by the following work appeareth.

	l.	*s.*	*d.*	
	134	16	08	$\frac{1}{4}$
	286	10	04	$\frac{3}{4}$
	498	13	06	$\frac{1}{2}$
	794	18	09	$\frac{1}{4}$
Sum	1714	19	04	$\frac{3}{4}$

Here Note once for all, that whatſoever Sums you are to add together, whether of Money, Weight, Meaſure, Time, *&c.* That when you come to the *greateſt denomination*, as you caſt up the *ſeveral Ranks thereof*, you are to carry the Tens of every preceding Rank to that which follows it, as is directed in the fifth Section of this Chapter, and as the

the Ranks in the Denomination of Pounds in the laſt Example are caſt up.

The Old common way of Addition of Money is to make a ſpeck or tittle with your Pen at every 12 that is found in the Addition of your Pence, and ſo many ſpecks as you find, carry ſo many Shillings to the place of Shillings, ſetting down what remains above 12 under the place of Pence. Then make a ſpeck at every 20 you find in the Addition of your Shillings, and for ſo many ſpecks carry ſo many Pounds to the place of Pounds, ſetting down the overpluſ under the place of Shillings, and then proceed to add up the Pounds.

But the beſt Method which I would commend to your Practice is this:

Firſt, caſt up your Pence, or make a ſmall Comma at every 60 *d.* which is 5 *s.* (and it will be a great eaſe to the Memory where Sums are long) and by the foregoing Table you may readily know how many Shillings and Pence your Pence amount to; then ſet down your odd Pence under the place of Pence, and carry your Shillings to the unite of Shillings, and add them up as in Addition of Numbers, by ſetting down the odd above the tens, and carry the tens to the tens of Shillings, or Angels (becauſe

10 *s.* is an Angel) then for every two in the place of Angels carry so many Pounds to the place of Pounds. An Example or two will make it plain and easie.

I. Example. *A Shop-keeper looking over his Shop-Book, finds that A ows him* 195 l. 11 s. 9 d. $\frac{1}{2}$. *B* 57 l. 14 s. 10 d. $\frac{1}{4}$. *C* 450 l. 10 s. 2 d. *D* 27 l. 16 s. 11 d. $\frac{3}{4}$. *E* 44 l. 13 s. 9 d. $\frac{1}{2}$. *F* 100 l. *G* 8 l. 14 s. 9 d. $\frac{1}{2}$. *H* 160 l. 10 s. 2 d. $\frac{1}{2}$. *I* 54 l. 11 s. 11 d. *K* 73 l. 9 s. 10 d. $\frac{1}{4}$.

In order to the work, place the Sums one under the other, as is before directed, thus.

	l.	*s.*	*d.*
A	195	11	9 $\frac{1}{2}$
B	57	14	10, $\frac{1}{4}$
C	450	10	2
D	27	16	11 $\frac{3}{4}$
E	44	13	9 $\frac{1}{2}$
F	100	00	0
G	8	14	9 $\frac{1}{2}$
H	160	10	2 $\frac{1}{2}$
I	54	11	11
K	73	9	10 $\frac{1}{4}$
Sum	1173	14	4 $\frac{1}{4}$

Then begin with the least Denomination towards the right hand, which is Farthings, saying, 1 and 2 is 3, and 2 is 5, and 2 is 7, and 3 is 10, and 1 is 11, and 2 is 13 Farthings, which is 3 Pence $\frac{1}{4}$, wherefore put down $\frac{1}{4}$ under the Farthings, and carry 3 Pence to the place of Pence, and say, 3 and 10 is 13, and 11 is 24, and 2 is 26, and 9 is 35, and 9 is 44, and 11 is 55, and 2 is 57, and

10

10 is 67,& 9 is 76. Now by your Table 72 is 6*s.* therefore 76 is 6*s.*4*d.* wherefore put down 4 *d.* under the place of Pence, and carry 6 *s.* to the place of Shillings, ſaying, 6 that you carry and 9 is 15, and 1 is 16, and 4 is 20, and 3 is 23, and 6 is 29, and 4 is 33, and 1 is 34, wherefore put down 4 under that place of Shillings, and carry three tens to the place of *Tens of Shillings*, or *Angels*, and ſay, 3 that you carry and 1 is 4, and 1 is 5, and 1 is 6, and 1 is 7, and 1 is 8, and 1 is 9, and 1 is 10, and 1 is 11; now, 11 Angels, or 11 ten Shillings is 5 *l.* 10 *s.* or 5 *l.* 1 Angel, therefore place 1 Angel under the Angels, and it makes the 4 to be 14 *s.* which place under the place of Shillings, and carry 5 Pound to the place of Pounds, and finiſh the Work as before directed; and the Total Sum found will appear to be 1173 *l.* 14 *s.* 4 *d.* $\frac{1}{4}$.

II. Example. *A Banker on the Ballance of his Books finds himſelf indebted to L* 50 l. 10 s. 3 d. $\frac{1}{4}$. *to M.* 100 l. 10 s. 10 d. *to N.* 25 l. 7 s. 8 d. $\frac{3}{4}$. *to O.* 59 l. 17 s. *to P.* 507 l. 16 s. 10 d. $\frac{1}{2}$. *to Q.* 7 l. 14 s. 9 d. $\frac{1}{4}$. *to R.* 37 s. 5 d. *to S.* 25 s. 11 d. $\frac{1}{2}$. *to T.* 415 l. 10 s. 9 d. *to V.* 76 l. 13 s. 9 d. $\frac{1}{2}$. *to W.* 100 l. *to X* 15 s. 11 d. $\frac{1}{2}$. *to Y.* 17 l. 17 s. *to Z.* 10 l. 00 s. 4 d. $\frac{1}{2}$.

First

	l.	*s.*	*d.*
L ——	50	10	$3\frac{1}{4}$
M ——	100	10	10
N ——	25	7	$8\frac{1}{4}$
O ——	59	17	0
P ——	507	16	$10,\frac{1}{2}$
Q ——	7	14	$9\frac{1}{4}$
R ——	1	17	0
S ——	1	5	$11\frac{1}{2}$
T ——	415	10	9
V ——	76	13	$9\frac{1}{2}$
W ——	100	00	0
X ——	00	15	$11\frac{1}{2}$
Y ——	17	17	0
Z ——	10	00	$4\frac{1}{2}$
Sum	1375	18	$3\frac{3}{4}$

First of all add up your Farthings, as before directed, and they make 15, which is 3 *d* ¾, place ¾ under the Farthings, and carry 3 Pence to the Pence, and ſay, 3 and 4 is 7, and 11 is 18, and 9 is 27, and 9 is 36, and 11 is 47, and 9 is 56, and 10 is 66, *at which* 10 *make a Comma, becauſe 66 d. is 5 s. 6 d.* then proceed and carry 6 *d.* to the next figure, which is 8, and ſay, 6 and 8 is 14, and 10 is 24, and 3 is 27. Now 27 *d.* is 2 *s.* 3 *d.* and the 5 *s.* before makes 7 *s.* 3 *d.* wherefore ſet down the 3 Pence under the place of Pence, and carry 7 Shillings to the place of Shillings, and proceed to finiſh your Sum as was taught you in the laſt precedent, and the Total Sum will appear to be 1375 *l.* 18 *s.* 3 *d.* ¾.

Addition

Addition of Averdupois *Weight.*

Note, *That* 16 *Drams is an Ounce*, 16 *Ounces is a Pound,* 28 *Pounds is a Quarter of an Hundred,* 4 *Quarters is an Hundred weight consisting of* 112 *pounds, and* 20 *Hundred is a Tun Averdupois weight.*

The Marks or Characters by which this weight is known or expressed are these, *viz. For Tuns* (*T.*) *Hundreds* (*C.*) *Quarters* (*Qr.*) *Pounds* (lb.) *Ounces* (*oz.*) *Drams* (*dra.*) As in the following Examples.

Tun.	C.	*qr.*	lb.
25	14	2	24.
57	16	3	25.
42	10	1	17
96	14	2	27.
54	17	2	18.
59	16	3	22.
75	14	2	19.
64	17	3	26
478	04	0	10

C.	*qr.*	lb.	*oz.*
154	1	19	10
275	3	16	11
476	2	19.	7
57	3	14	8
45	1	10	10
17	2	22	11
45	3	17	9
76	2	19	14
1150	2	01	00

Let it be required to add up the Sum above, expressing *Tun.* C. *qr.* & lb. First, add up the Pounds by making a speck or tittle at every 28 you find in the place of Pounds, as you may see in the above-mentioned Example,

ple, where is found to be six specks, and 10 ℔. over, which 10 place under the denomination of Pounds, and carry 6 to the Quarters, and add them up, they make 24, which is 6 C. for which put a (0) under the place of *qrs.* and carry 6 C. to the place of C. Then proceed to add up your C. after the same manner as you carry from Shillings to Pounds, because 20 C. make a *Tun*. Lastly, add up the Tuns, and the Total will appear to be 478 *Tun.* 04 C. 0 *qr.* 10 ℔.

With *Troy weight* are weighed Bread, Gold, Silver, and Electuaries. And with *Averdupois weight* are weighed Butter, Cheese, Flesh, Wax, Tallow, Pitch, Rozen, Lead, Iron, all sorts of Grocery Wares, and all such kind of garble whence there may issue a waste.

The Pound *Averdupois*, containing 16 Ounces, is equal to 14 *oz.* 12 *pw. Troy weight*. And the Pound *Troy weight*, consisting of 12 Ounces, is about 13 Ounces 2 Drams and an half of *Averdupois weight*; so that he who tells you a pound of bread is as heavy as a pound of Cheese is very much mistaken, the one being a pound *Troy*, and the other a pound *Averdupois weight*.

WOOL is also weighed with *Averdupois weight*, but the Divisions are somewhat different, *viz.* for Wool, 7 *Pounds*

7 Pounds is a Clove, 2 Cloves is a Stone, 2 Stone is a Todd, 6 Todds 1 Stone, or 12 Stone, is a Wey, 2 Weys is a Sack, and 12 Sacks is a Last of Wool.

Note that according to the foregoing Division 182 ℔. is a *Wey*, but in some Countries the *Wey* is 256 ℔. *Averdupois*, as in *Suffolk*, &c. And in *Essex* there is 336 ℔. in a *Wey*.

Addition of Apothecaries Weights.

Apothecaries weights are the same in the main with *Troy weight*, only the Subdivisions of the pound are different, as followeth, *viz.*

Note, that 20 Grains is a Scruple, 3 Scruples is a Dram, 8 Drams is an Ounce, and 12 Ounces is a Pound weight. The Marks or Characters by which Apothecaries weights are known are these, *viz. For Pounds* (℔.) *Ounces* (℥) *Drams* (ʒ) *Scruples* (℈) *and Grains* (*gr.*)

℔.	℥.	ʒ.	℈.	gr.
76	09	2	0	15
54	10	5	2	17
68	11	7	1	13
28	04	4	1	12
16	10	0	2	18
35	06	1	0	14
281	04	6	1	09

Addition

Addition of Troy Weight.

Note, That 24 Grains is a Penny-weight, 20 Penny-weights is an Ounce, and 12 Ounces is a Pound Troy weight.

The Notes or Characters by which *Troy weight* is known are theſe, *viz.* The Mark of Pounds is (℔.) of Ounces (*oz.*) of Penny-weights (*pw.*) of Grains (*gr.*)

Let it be required to add the following particulars together, *viz.* 24 ℔.--09 *oz.*--06 *pw.* --11 *gr.* and 164 ℔. 10 *oz.* --14 *pw.* ---18 *gr.* and 82 ℔.---7 *oz.*---17 *pw.*---20 *gr.* and 8 ℔. 11 *oz.*--18 *pw.*--22 *gr.*

Now, in order to find out the Sum of theſe given Quantities, I place them one under the other orderly, as you ſee in the Margent, and draw a line under them. Then I begin with the Denomination of Grains, making a prick with the Pen at every 24 (for eaſe) and bear the overplus to the next above, ſaying, 22 and

℔.	*oz.*	*pw.*	*gr.*
24	09	06	11
164	10	14	18.
82	07	17	20.
8	11	18	22
281	03	17	23

20 is 42, which is 18 above 24, wherefore I make a Mark at 20, and carry the 18 up higher, ſaying, 18 and 18 is 36, which is 12 above 24, wherefore I make a Mark at 18,

and carry the 12 to the next above, ſaying, 12 and 11 make 23, which I put under the line in its proper place, and obſerve how many Pricks I have made in caſting up this Denomination, which I find to be 2, wherefore I carry 2 to the next, and proceed (as in the ſhillings in *Addition of Money*, becauſe I carry 1 for every 20) ſaying, 2 and 8 is 10, and 7 i 7, and 4 is 21, and 6 is 27, and (then down again with the Tens) 10 is 37, and 10 is 47, and 10 is 57 Penny-weights, which is 2 *oz.* 17 *pw.* wherefore I put 17 *pw.* in its place under the line, and carry the 2 *oz.* ſaying, 2 that I carry and 1 is 3, and 7 is 10, and 9 is 19, and 10 is 29, and 10 is 39 Ounces, which is 3 ℔.-3 *oz.* wherefore I put the 3 Ounces in its proper place under the line, and carry the 3 ℔. to the Pounds, and proceed to finiſh the work as before is directed, which being done, I find the total Sum to be 281 ℔.-3 *oz.*-17 *pw.*-23 *gr.* as in the Margent.

More Examples for Practice follow.

℔.	*oz.*	*pw.*	*gr.*
379	05	14	18.
168	11	17	14
794	09	10	22.
634	10	18	20.
75	06	11	15.
34	00	06	16
2087	09	00	09

℔.	*oz.*	*pw.*	*gr.*
297	10	07	13
768	09	14	06
635	11	18	21.
74	08	18	19.
35	10	14	14.
24	06	16	18
1837	10	10	19

Addition

Addition of Liquid Measure.

The least Denomination in Liquid Measure is a Pint, which was heretofore deduced from a Pound Troy weight, a pound of Wheat Troy weight making a Pint Liquid Measure, but in regard of the disagreement thereof with the Rules of Solid Geometry in the gauging of Brewers Vessels, some taking 288 solid Inches for a Gallon, some 286, *&c.* it occasioned a difference between the Brewers and the Managers of His Majesties Excise, till the Parliament taking the matter into Consideration, stated the difference between them, the Statute ordaining 231 solid Inches to make a Gallon of Wine Measure, and 282 solid Inches in a gallon of Beer Measure, and the gallon being subdivided into 2 pottles, each pottle into 2 quarts, and each quart into 2 pints, so that the pint being the eighth part of a gallon, must contain 28 solid Inches and 7 eighth parts of an Inch for Wine measure, and 35 solid Inches and a quarter for Beer measure. *Wherefore note that* $35\frac{1}{4}$ *solid Inches make a pint Beer Measure,* 2 *pints is a quart,* 2 *quarts is a pottle,* 2 *pottles is a gallon,* 8 *gallons is a firkin of Ale,* 9 *gallons is a firkin of Beer,* 2 *firkins is a Kilderkin, and* 2 *Kilderkins is a Barrel.*

In Wine Measure,

$35\frac{7}{8}$ *solid Inches is a Pint, 2 Pints is a Quart, 2 Quarts is a Pottle, 2 Pottles is a Gallon, 42 Gallons is a Terce, or third part of a Pipe or Butt, 63 Gallons is a Hogshead, 2 Hogsheads is a Pipe or Butt, and 2 pipes or butts is a Tun of Wine.*

Examples of *Wine Measure.*

T.	*hhds.*	*gal.*	*pts.*	*T.*	*hhds.*	*gal.*	*pts.*
37	3	18	5	240	1	48	3
48	2	24	0	196	3	22	1
67	1	20	6	97	3	51	5
38	2	17	7	85	2	17	6
79	0	47	3	43	0	25	0
64	1	52	4	93	1	38	5
335	3	55	1	757	1	14	4

Addition of Dry Measure.

The least Denominative part of dry measure is a pint, which is taken from *Troy weight.*

With these are measured all dry substances, as *Corn, Salt, Coal, Sand, &c.* the Table followeth.

In Dry measure, Note that 2 *Pints make a Quart,* 2 *Quarts a Pottle,* 2 *Pottles a Gallon,* 2 *Gallons a Peck,* 4 *Pecks a Bushel Land measure,* 5 *Pecks a Bushel Water measure,* 8 *Bushels a Quarter,* 4 *Quarters a Chalder, and* 5 *Quarters a Wey.*

Examples

Examples of Dry Measure.

Chald.	qrs.	bush.	pec.
148	3	6	3
375	1	7	2
296	2	4	3
128	1	5	0
94	0	5	2
38	2	4	3
1082	1	2	1

Chald.	qrs.	bush.	pec.
227	1	5	0
742	3	7	1
148	2	4	1
97	2	6	3
48	0	3	0
62	3	1	1
1327	2	3	2

Addition of Long Measure.

Long Measure is Originally deduced from a Barley-Corn taken out of the middle of the Ear and well dried, from whence is deduced the following Table, *viz.*

In Long Measure, Note that 3 *Barley-Corns make an Inch*, 12 *Inches a Foot*, 3 *Foot a Yard*, 3 *Foot* 9 *Inches*, *or a Yard and Quarter is an Ell* English, 6 *Feet a Fathom*, 5 *Yards and an half*, *or* 16 *Feet and an half make one Statute Pole*, *or Perch*, 30 *Poles or Perches make a Furlong*, *and* 8 *Furlongs make an* English *Mile.*

Examples of Long Measure.

Miles	Fur.	Perch
48	7	24
37	3	18
65	5	28
36	4	30
107	0	31
205	6	17
506	6	04

Miles	Fur.	Perch
134	3	18
342	4	24
179	5	16
84	0	25
76	7	27
84	2	13
902	1	03

Addition of Cloth Measure.

Note that 4 *Nails make a quarter of a Yard,* 3 *quarters of a Yard make an Ell* Flemish, 4 *quarters a Yard* English, 5 *quarters of a Yard an Ell* English.

Examples of Cloth Measure.

yds.	qrs.	na.
137	3	3
295	1	2
112	2	3
215	0	1
174	1	2
764	3	0
1700	0	3

Ells	qrs.	na.
376	2	0
178	3	3
742	3	1
97	2	2
84	1	2
68	0	3
1547	3	3

Ell fl.	qrs.	na.
184	1	2
357	2	1
475	2	2
251	1	0
164	0	2
87	1	3
1521	0	2

Addition

Addition of Land Measure.

From the foregoing Table of Long Measure, is all superficial Measure deduced, that of Land Measure being as followeth; *viz.*

In Land Measure, 40 square Poles or Perches make a Rood, and 4 Roods make an Acre.

Examples of Land Measure.

Acr.Rood.Per.	*Acr. Rood.Per.*	*Acr. Rood.Per.*
120—2—34	164—1—20	320—3—10
275—3—14	130—3—25	180—1—19
162—1—35	644—2—17	672—3—28
98—2—20	563—0—24	191—0—12
47—3—30	372—3—18	634—1—15
64—1—15	140—1—26	87—2—14
769—3—28	2016—1—10	2087—0—18

Of Time.

The Denominative parts of Time are Originally deduced from the Sun's Motion in the Heavens, which is carried round the same from *East* to *West* by the Rapid Motion of the *Primum Mobile* in one day Natural, which day is divided into 24 supposed equal parts, called Hours, and each Hour is sub-divided into 60 Minutes, *&c.* whence ariseth the following Table, *viz.*

In *Time*, Note, That 60 *Minutes make an Hour*, 24 *Hours make a Natural Day*, 7 *Days make a Week*, 4 *Weeks make a Month, consisting of* 28 *Days*, 13 *Months* 1 *Day and* 6 *Hours make a Year.*

However in the ordinary Computation of Time the Year is divided into 12 unequal Calendar Months, whose names, and the number of days that each containeth, are as followeth, *viz.*

	days.
January	31
February	28
March	31
April	30
May	31
June	30
July	31
August	31
September	30
October	31
November	30
December	31

Note, That the 6 odd Hours is reckoned but once in 4 Years, and then one whole day is added to that Year, making it to consist of 366 days, and is called *Leap-Year*; the said day is added to *February*, which then containeth 29 days.

Note also, *that the Minute is usually sub-divided into* 60 *Seconds, and each Second into* 60 *Thirds*, &c.

The Tropical Year, by the Observations of the most Accurate Astronomers, is found to consist of 365 Days, 5 Hours, 49 Minutes, 4 Seconds, and 21 Thirds.

The Proof of Addition.

VII. To prove the work of Addition, draw a line with the Pen under the uppermoſt number, and then add together all the other numbers, except that uppermoſt number, and when you have ſo done, add the amount or ſum thereof to the ſaid uppermoſt number, and if that ſum be equal to the ſum firſt found, then is the work truly performed, otherwiſe not.

Example.

Let us prove the firſt example of the ſeventh Rule, where the Sum is found to be 1714 *l.* 19 *s.* 4 *d.* $\frac{3}{4}$. and firſt having drawn a line under the firſt number, I add together all the reſt, and find their Sum to be 1580 *l.* 2 *s.* 8 *d.* $\frac{1}{2}$. which being added to the ſaid uppermoſt number 134 *l.* 16 *s.* 8 *d.* $\frac{1}{4}$. their ſum is 1714 *l.* 19 *s.* 4 *d.* $\frac{3}{4}$. which is equal to the Sum firſt found, which proves the work to be true. The like of any other.

	l.	*s.*	*d.*
	134	16	08 — $\frac{1}{4}$
	286	10	04 — $\frac{3}{4}$
	498	13	06 — $\frac{1}{2}$
	794	18	09 — $\frac{1}{4}$
	1714	19	04 — $\frac{3}{4}$
	1580	02	08 — $\frac{1}{2}$
proo.	1714	19	04 — $\frac{3}{4}$

CHAP. III.

Of SUBTRACTION.

I. *SUBTRACTION Teacheth to take a leſſer Number from a greater, or an equal from an equal; whereby we diſcover the Remainder, Exceſs, or Difference.*

II. *In Subtraction* if the Numbers given be Integers, that is, conſiſting only of one Denomination, then place the biggeſt number uppermoſt, and the leſſer in Order under it, *viz.* Units under Units, Tens under Tens, Hundreds under Hundreds, *&c.* And draw a line under them.

III. Then begin at the place of Units, taking the lowermoſt Figure out of the uppermoſt, and place the Remainder under the line, then proceed to the place of Tens, and do in the ſame manner, and then to the place of Hundreds, *&c.* till the whole work be finiſhed; Then ſhall the Number under the ſaid Line be the Remainder or Difference.

Example. Let it be required to find the difference between 48 and 16?

Firſt, I put down the biggeſt number 48, and place 16 the leſſer number under it, and under both I draw a line as you ſee in the Margent; then I begin at the place of Units,

Units, ſaying, 6 out of 8 and there Remains 2, which I place under the Line, and proceed to the next place, ſaying, 1 from 4 and there remains 3, which I likewiſe place under the Line, and the work is finiſhed. So that I find the remainder or difference between 48 and 16 to be 32, as you may ſee by the work in the Margent.

	48
	16
	32

More Examples of the like nature follow.

From	743	586	3785	1842
Subtr.	121	270	205	342
Remains	622	316	3580	1500

But if the particular figure which you are to *Subtract* be greater than the figure out of which it is to be *Subtracted*, then you are to borrow 10 and add it to the uppermoſt Figure, and then *Subtract* the ſaid lowermoſt Figure from their Sum, and place the *Remainder* underneath the Line, and for that which you borrowed add 1 to the next Figure in the lowermoſt Line, and proceed. Let this be repeated as often as there is occaſion.

Example.

Example. Let it be required to Subtract 3872 from 43758.

The given Numbers being placed, and a line drawn under them, as is before directed, I begin at the Right Hand, ſaying, 2 from 8 and there remains 6, which I ſet under the line, and proceed, ſaying, 7 from 5 I cannot, but 7 from 15 and there remains 8, which I put under the line, and proceed to the next, ſaying, 1 that I borrow'd and 8 is 9 from 7 I cannot, but 9 from 17 and there remains 8, which I put under the line, and proceed to the next Figure, ſaying, 1 that I borrowed and 3 is 4 from 3 I cannot, but 4 from 13 and there remains 9, which I put under the line, now becauſe there is no Figure ſtanding under the 4, I therefore ſuppoſe a (0) Cypher to be placed there, and becauſe I borrowed 1 at the laſt Figure, therefore I pay it here by Subtracting it out of the 4, ſaying, 1 that I borrowed out of 4 and there remains 3, which I put under the line, and the work is finiſhed; and I find (after the work of Subtraction is ended) the remainder to be 39886: Theſe Examples being well underſtood, will render what follows to be plain and eaſie.

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43758
 3872
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39886
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Other Examples for Practice follow.

From	7458	50876	10008576
Subtr.	467	947	8743
Remains	6991	49929	9999833
From	5100	30210	15764
Take	1754	10325	7276
Reſt	3346	19885	8488
Proof	5100	30210	15764

The Proof of Subtraction.

For Proof of Subſtraction, add the Reſt, or Remainder, to the Number Subtracted, and if the Sum be equal to the uppermoſt Number (*being the Number from whence Subtraction is made*) your work is true, otherwiſe falſe, as you may ſee in the laſt Example of Subtraction above-mentioned.

Subſtraction of Money.

IV. If the given Numbers conſiſt of divers Denominations, ſuch as *Money*, *Weight*, *Meaſure*, *Time*, &c. Then you are to place the leſſer Number under the greater, in ſuch ſort that each Denomination may ſtand under its correſpondent Name, as has been directed in *Addition*, and draw a line under them.

Then

Then proceed to *Subtract* the undermost from the uppermost, beginning at the least Denomination, and proceeding gradually towards the Left hand, setting the *Remainder* of each Denomination under the line until the whole be finished; As for *Example*.

Let it be required to Subtract 126 *l.*—07 *s.* 04 *d.*—¼. from 254 *l.*—13 *s.*—10 *d.*—¾. first, I place them down, the lesser under the greater, and draw a line under them, as you see in the Margent.

Then I begin at the Right hand, saying, 1 Farthing from 3 Farthings, and there remains 2, which I put under the line in the place of Farthings, and proceed to the Denomination of Pence, saying, 4 from 10, and there remains 6, which I put under the line in the place of Pence, and then I go to the Denomination of Shillings, saying, 7 from 13, and there rests 6, which I put under the line in the place of Shillings, and then I proceed to finish the Work according to the third Rule of this Chapter; which being ended, I find the Remainder to be 128 *l.*—06 *s.*—06 *d.*—½. as you see in the Margent.

l.	*s.*	*d.*	
254—	13—	10—	¾
126—	07—	04—	¼
128—	06—	06—	½

V. But

V. But if the lowermost Number in any of the Denominations chance to be greater than the uppermost, you must in such case borrow an Unit from the next greater Denomination, *Subtracting* the lowest Number there-from, and *adding the Remainder* to the said uppermost Number, and place that Sum under the line; and then proceed, adding 1 to the next lowermost Number to the Left hand for that you borrowed, *&c.*

A few Examples will make this Rule very plain. Let it be required to subtract 178*l.* 15*s.* 9*d.* $\frac{1}{4}$. from 348 *l.* 12 *s.* 7 *d.* $\frac{3}{4}$ First, I place them down in order, as has been before directed, & draw a line under them. Then

l.	*s.*	*d.*	
348	12	07	$\frac{3}{4}$
178	15	09	$\frac{1}{4}$
169	16	10	$\frac{1}{2}$

I begin at the Right hand with the Denomination of Farthings, saying, 1 from 3 and there remains 2, which I put under the line, and proceed to the Denomination of Pence, saying, 9 pence out of 7 pence I cannot, but (borrowing 1 from the next Denomination, which is Shillings, and makes 12 pence, I say) 9 from 12 and there remains 3, which I add to the 7 pence and that makes 10 pence, wherefore I put 10 pence under the line, and proceed to the next Denomination, which is Shillings,

Shillings, and ſay, 1 that I borrowed and 15 is 16 from 12 I cannot, but (borrowing 1 Pound from the next Denomination, which is 20 Shillings) 16 from 20 and there remains 4, which added to the ſaid 12 makes 16 ſhillings, which I ſet down under the line, and proceed to the Pounds, ſaying, 1 that I borrowed and 8 is 9 from 8 I cannot, but 9 from 18, *&c.* And the Work being finiſhed, I find the Remainder to be 169 *l.*--16 *s.*--10 *d.*--½. as appears by the Work in the Margent.

Examples for Practice.

	l. *s.* *d.*	*l.* *s.* *d.*
Received	295—11—03 ¼	415—00—05 ½
Paid	107—14—09 ½	107—11—08 ¾
Reſt	187—16—05 ¾	347—08—08 ¾
Proof	295—11—03 ¼	415—00—05 ½
Debtor	100—00—00	1072—01—05
Creditor	75—00—09	107—16—10 ½
Ballance	24—19—03	964—04—06 ½
Proof	100—00—00	1072—01—05

Received

	l. s. d.	l. s. d.
Received	1010—10—10	100—00—09 ½
Disburst	942—13—11 ½	47—00—10
Rest	67—16—10 ½	52—19—11 ½
Proof	1010—10—10 ½	100—00—09 ½

VI. If a Sum be lent, and payment thereof made at several times in part, and you would know how much remains due, in this case you must add the several Payments into one Sum, and Subtract that Sum from the Sum lent, and the Remainder will shew how much is due. An Example or two will make it plain and easie.

	l. s. d.	l. s. d.
Lent	3475—10—05	572—11—05
Paid at several times.	358—14—07 ½	154—09—07 ¼
	514—07—11 ¾	95—10—07
	294—16—09	6—14—05 ½
	344—10—08 ½	72—11—04
	365—15—10 ¼	16—17—02
	795—15—07 ¼	9—14—11 ½
	462—14—08	164—17—09
paid in all	3136—16—02 ¼	520—15—10 ¼
Rest due	338—14—02 ¾	51—15—06 ¾
Proof	3475—10—05	572—11—05

Example.

Examples.

	℔.	s.	d.
Lent	4768	17	10 ¼
Received at ſeveral Times.	347	14	06 ½
	785	11	11 ¾
	128	15	09 ½
	420	16	05
	124	00	02 ¾
Received in all	1806	18	11 ¼
Remains due	2961	18	11

	l.	s.	d.	l.	s.	d.
Borrowed	3475	10	05	4620	00	00
Paid at ſeveral times.	358	14	07 ½	409	09	10
	514	07	11 ¾	276	15	07 ¼
	294	16	09	195	13	11 ¾
	344	10	08 ½	167	19	10 ½
	365	15	10 ¼	984	16	05 ¼
	792	05	06 ½	785	07	06
Paid in all	2670	11	05 ½	2820	03	02 ¾
Reſts due	804	18	11 ½	1799	16	09 ¼
Proof	3475	10	05	4620	00	00

Let

Let us prove the Example of the fifth Rule in Subtraction of Money, where it is required to Subtract 178 *l.* 15 *s.* 9 *d.* $\frac{1}{4}$. from 348 *l.* 12 *s.* 7 *d.* $\frac{3}{4}$.

In this Examp. the remainder is found to be 169 *l.* 16*s.* 10 *d.* $\frac{1}{2}$.which I add to 178*l.* 15*s.* 9 *d.* $\frac{1}{4}$. (the number given to be subtracted) and the Sum is 348 *l.* 12 *s.* 7*d.* $\frac{3}{4}$. which is equal to the uppermost of the given numbers, wherefore I conclude the Subtraction to be truly wrought.

	l.	*s.*	*d.*
From	348	12	07 $\frac{3}{4}$
Subtr.	178	15	09 $\frac{1}{4}$
Remain	169	16	10 $\frac{1}{2}$
Proof	348	12	07 $\frac{3}{4}$

Here follow other Examples in Subtraction, together with their proof, for the Learners Practice.

Subtraction of Averdupois Weight.

A Salter buys 45 Tun, 7 C. 1 qr. 12 ℔. *of Log-wood, of which he* sold 19 Tun, 14 C. 1 qr. 18 ℔.

In order to the Work, I dispose of the given Numbers according to the directions of the Fourth Rule of this Chapter, drawing a line under them, as you see in the Margent.

Then

Then I begin at the Right hand, which is pound weights, ſaying, 18 out of 12 I cannot, but 18 out of 28 (borrowing a qr. of a C. (*which is* 28 ℔.) and there remains 10, to which add the 12 ℔. it makes 22 ℔, which I place under the ℔, and carry 1 to the quarters, and say, 1 that I borrowed and 1 is 2, now 2 quarters out of 1 I cannot, but 2 out of 4 quarters (*which is a C weight*) there remains 2, to which add the 1 quarter, it makes 3, which I place under the qrs. and proceed to the C. and ſay, 1 that I borrowed and 14 C. is 15 C. now 15 C. out of 7 C. I cannot, but 15 C. out of 20 C. (*which is* 1 *Tun*) there remains 5, to which add the 7 C. it makes 12 C. which I place under the C. and proceed to the Tuns, and ſay, 1 that I carried and 9 is 10, 10 out of 5 I cannot, but 10 out of 15, reſt 5, and carry 1, and ſay, 1 I carry and 1 is 2, 2 out of 4 there remains 2, and the Work is finiſhed, and I find the *Remainder* or *Difference* to be 25 *Tun*, 12 C. 3 *qrs*. 22 ℔.

Tun.	*C.*	*qrs.*	℔.
45	07	1	12
19	14	1	18
25	12	3	22

More

More Examples for the Learners Practice.

	Tun. C. qr. ℔.	C. qr. ℔.
Bought	107—10—2— 5	74—0—15
Sold	94—17—3—10	19—1—11
Rest	12—12—2—23	54—3— 4
Proof	107—10—2— 5	74—0—15

	C. qrs. ℔	C. qrs. ℔.
Bought	194—3—27	454—1—17
Sold	99—2—16	196—3—22
Unsold	95—1—11	257—1—23
Proof	194—3—27	454—1—17

If ſeveral Quantities in *Groſs weight* be given, out of which you would Subtract the *Tare*, in ſuch a caſe add the Groſs weight into one Total: And add the Tare likewiſe into one Total. Then Subtract the Total of the *Tare* from the Total of the *Groſs*, the Remainder is *Neat* weight.

Example.

Example. *A Merchant sells 6 Hogsheads of Sugar*, viz.

	C. qrs. ℔.		C. qrs. ℔.
N° 1. Gr.	14—2—10	Tare	1—3—15
2	17—1—19		2—0—05
3	16—2—14		2—1—10
4	17—1—10		2—1—16
5	18—2—17		2—1—12
6	14—1—22		1—3—22
Gross	99—0—08	Tare	12—3—24
Tare	12—3—24		
Rest Neat	86—0—12		

Subtraction of Troy weight.

	oz. pw. gr.	oz. pw. gr.
Bought	115—07—05	976—11—06
Sold	94—13—10	149—14—11
Rest	20—13—19	826—16—19
Proof	115—07—05	976—11—06

	℔. oz. pw.	℔. oz. pw. gr.
Bought	375—05—13 ½	194—3—09—16
Sold	196—10—17 ¼	95—7—14—18
Rest	178—06—16 ¼	98—7—14—22
Proof	375—05—13 ½	194—3—09—16

I

I might proceed to give Examples in Subtraction of Liquid Meaſure, Dry Meaſure, Long Meaſure, Apothecaries Weights, Time, Motion, *&c.* but there being no more difference between the working of theſe and thoſe Examples, than only obſerving the Tables of each, which are delivered in the ſecond Chapter, therefore I forbear, this being ſufficient for the meaneſt Capacity.

CHAP. IV.

Of MULTIPLICATION.

I. IN Multiplication there are always two Numbers given to find out a third, which ſhall contain either of the given Numbers as many times as the other containeth an Unite.

II. Of the two Numbers given the one is called the *Multiplicand*, and the other is called the *Multiplier*, and the Number found out by the Operation is called the *Product*.

III. The *Multiplicand* is the Number given to be Multiplied, and is uſually, for orders ſake, the biggeſt of the two given Numbers.

IV. The

IV. The *Multiplier* is that by which the *Multiplicand* is Multiplied, and is uſually the leaſt Number.

V. The *Product* is the Number produced by the Multiplication, and it containeth the *Multiplier* as many times as the *Multiplicand* containeth Unites; or it containeth the *Multiplicand* as often as the *Multiplier* containeth Unites.

VI. *Multiplication* is either Simple or Compound.

VII. *Simple Multiplication* is when the Multiplicand and Multiplier, do each of them conſiſt of one ſingle figure only: As if it were required to Multiply 4 by 3, 5 by 2, 9 by 7, *&c.* Here 3 times 4 is 12, and 2 times 5 is 10, and 7 times 9 is 63; now 12, 10, and 63, are the *Products* of each Multiplication.

VIII. All the variety of *Simple Multiplication* is contained in the following Table, which muſt be learned by heart, before the Learner can make any further progreſs.

Multiplication

Multiplication TABLE.

2 times	2	is	4
	3		6
	4		8
	5		10
	6		12
	7		14
	8		16
	9		18
	10		20
	11		22
	12		24

3 times	3	is	9
	4		12
	5		15
	6		18
	7		21
	8		24
	9		27
	10		30
	11		33
	12		36

4 times	4	is	16
	5		20
	6		24
	7		28
	8		32
	9		36
	10		40
	11		44
	12		48

5 times	5	is	25
	6		30
	7		35
	8		40
	9		45
	10		50
	11		55
	12		60

6 times	6	is	36
	7		42
	8		48
	9		54
	10		60
	11		66
	12		72

7 times	7	is	49
	8		56
	9		63
	10		70
	11		77
	12		84

8 times	8	is	64
	9		72
	10		80
	11		88
	12		96

9 times	9	is	81
	10		90
	11		99
	12		108

IX. *Compound Multiplication* is when the *Multiplicand, or Multiplier*, or both of them, do consist of *Compound Numbers*, that is, of more Figures or Places than one.

As if it were required to Multiply 324 by 2, here the *Multiplicand* is 324, which consisteth of 3 places, and the *Multiplier* is 2.

X. When it is required to Multiply one Number by another, first set down the biggest Number for the Multiplicand, and under that the *Multiplier*, in such order as has been taught in Addition and Subtraction, *viz.* Unites under Unites, Tens under Tens, *&c.* and draw a line under them.

As if it were required to Multiply 324 by 2, I set them down as followeth, *viz.*

The Multiplicand	324
The Multiplier	2

Then I begin with the place of Unites, saying, 2 times 4 is 8, which I put under the line; then 2 times 2 is 4, which I also put under the line; and 2 times 3 is 6, which I also put under the line, and the Work is finished: So that I find 324 being Multiplied by 2 produceth 648, as by the following Work.

The

The Multiplicand	324
The Multiplier	2
The Product	648

XI. When the Product of any single Figures amounts to 10, or a certain number of Tens, then you are to set down a Cypher, and carry an Unite for every Ten to the Product of the next Figure; or if it comes to above 10, or any number of Tens, then set down the excess, and carry an Unite for every Ten, *&c.* as in the following Example.

Let it be required to Multiply 785641 by 5: The numbers being set down according to the Tenth Rule, I begin, saying, 5 times 1 is 5, which I put under the line, and proceed, saying, 5 times 4 is 20, wherefore I put down 0, and carry 2 for the two Tens to the next, saying, 5 times 6 is 30, and 2 that I carried is 32, wherefore I put down 2, and carry 3 for the 3 Tens to the next Figure, saying, 5 times 5 is 25, and 3 that I carried is 28, wherefore I put down 8, and carry 2 to the next, saying, 5 times 8 is 40, and 2 that I carry is 42, so I put down 2, and carry 4 to the next Figure, saying, 5 times 7 is 35, and 4 that I carried is 39, which being the last Figure,

$$\begin{array}{r} 785641 \\ 5 \\ \hline 3928205 \end{array}$$

I put down 39 under the line, and so the Work is finished, and I find that 785641, being Multiplied by 5, the Product is 3928205, as appears by the whole Work in the Margent.

And here by the way, Note, *that Multiplication is a Compendious performance of Addition*, for in the last Example, if instead of Multiplying 785641 by 5, I put down the Multiplicand 5 times in order one under the other, and add them all together; then will the Sum of them amount to the Product that was found by the foregoing Work of Multiplication, as appears by the Work in the Margent. The same may be performed by any other Example.

785641
785641
785641
785641
785641
3928205

Other Examples of this Rule for Practice may be such as follow.

748046	570084	7115083
4	6	8
2992184	3420504	56920664
72190	35726	145796
9	5	10
649710	178630	1457960

XII. When

XII. When the *Multiplier* consists of divers places, then must there be as many *particular Products* as there are places therein, and for the true placing of each Product, observe to put the first Figure, or place of Unites under its proper *Multiplier*, and when you have done, draw a line under the whole Work, and add the *several Products* together, and their Sum will be the total Product required.

Example.

Let it be required to Multiply 46753 *by* 46.

Having placed the given Numbers in order to the Work, according to the Tenth Rule of this Chapter, and drawn a line under them, as you see in the Margent; I begin to Multiply with the 6, saying, 6 times 3 is 18, wherefore I put down 8 under the line, and carry 1 to the next, saying, 6 time 5 is 30, and 1 that I carry is 31, *&c.* so that the Product by 6 is 280518. Then I begin with the 4, saying, 4 times 3 is 12, wherefore I put down 2 (under the line, and under the Figure 4 by which I Multiply) and carry 1 for the

```
  46753
     46
 ------
 280518
187012
 ------
2150638
```

the Ten to the next, saying, 4 times 5 is 20, and 1 that I carry is 21, wherefore I set down 1, and carry 2 to the next, *&c.* and I find the single Product by 4 to be 187012, and so the Multiplication is ended: Then I draw a line under these two particular Products, and add them together in the order as they stand, and the Sum is 2150638, which is the true Product of 46753 being Multiplied by 46, that is, 46 times 46753, is 2150638, and is equal to the Sum of 46753, being set 46 times one under another and added together. Behold the whole work of Multiplication in the Margent of the last Page.

Example II.

Let it be required to Multiply 5800846 *by* 478.

First, I dispose of the given Numbers in order to the Operation, according to the tenth Rule foregoing.

Then I begin and Multiply the whole *Multiplicand* by (the first Figure of the *Multiplier*) 8; and the Product thereof is 46406768; then I Multiply the same again by (the second Figure of the Multiplier) 7, and the Product thereof is 40605922, the first Figure whereof, *viz.* 2,

I

I place under the 7, by which I Multiply. Then I proceed to Multiply by 4, and the *Product* thence arising is 23203384; the first Figure whereof, which is 4, I place under 4, by which I Multiply, and all the rest in their order, and so the whole work of Multiplication is finished: Then I draw a line under all, and add up the several Products, and their Sum is 2772804388, which is the total Product.

```
   5800846
       478
----------
  46406768
 40605922
23203384
----------
2772804388
```

A General Rule in Multiplication, is chiefly to observe, That in whatsoever place the Figure of the *Multiplier* (whether a Cypher or not) stands from the place of *Unites*, in the same place must the first Figure of that Multiplication be set from the *Unite* of the *Multiplicand.*

And since the greatest Difficulty in Multiplication arises from having a Cypher or Cyphers in the *Multipliers*, I shall endeavour to make it plain and easie by the following Examples.

the Ten to the next, ſaying, 4 times 5 is 20, and 1 that I carry is 21, wherefore I ſet down 1, and carry 2 to the next, *&c.* and I find the ſingle Product by 4 to be 187012, and ſo the Multiplication is ended: Then I draw a line under theſe two particular Products, and add them together in the order as they ſtand, and the Sum is 2150638, which is the true Product of 46753 being Multiplied by 46, that is, 46 times 46753, is 2150638, and is equal to the Sum of 46753, being ſet 46 times one under another and added together. Behold the whole work of Multiplication in the Margent of the laſt Page.

Example II.

Let it be required to Multiply 5800846 *by* 478.

Firſt, I diſpoſe of the given Numbers in order to the Operation, according to the tenth Rule foregoing.

Then I begin and Multiply the whole *Multiplicand* by (the firſt Figure of the *Multiplier*) 8; and the Product thereof is 46406768; then I Multiply the ſame again by (the ſecond Figure of the Multiplier) 7, and the Product thereof is 40605922, the firſt Figure whereof, *viz.* 2,

I

I place under the 7, by which I Multiply. Then I proceed to Multiply by 4, and the *Product* thence arising is 23203384; the first Figure whereof, which is 4, I place under 4, by which I Multiply, and all the rest in their order, and so the whole work of Multiplication is finished: Then I draw a line under all, and add up the several Products, and their Sum is 2772804388, which is the total Product.

```
     5800846
         478
  ----------
    46406768
   40605922
  23203384
  ----------
  2772804388
```

A General Rule in Multiplication, is chiefly to observe, That in whatsoever place the Figure of the *Multiplier* (whether a Cypher or not) stands from the place of *Unites,* in the same place must the first Figure of that Multiplication be set from the *Unite* of the *Multiplicand.*

And since the greatest Difficulty in Multiplication arises from having a Cypher or Cyphers in the *Multipliers,* I shall endeavour to make it plain and easie by the following Examples.

Example 1. Where there is one or more Cyphers in the *Multiplier* between significant Figures.

(2)	(1)
45793	8465008
507	4006
———	———
320551	50790048
2289650	3386003200
———	———
23217051	33910822048

In the first Example you see that the Cyphers are put at the same distance from the Unite of the *Multiplicand* that they stand in from the Unite of the *Multiplier*; as 4, the fourth Figure of the *Multiplier* (the first Figure in that Multiplication, which is 2) is set in the fourth place from the Unite of the *Multiplicand.*

Example 2. Where the *Multiplier* hath one or more Cyphers to the right hand thereof.

(1)	(2)
546735	7645932
4620	48000
———	———
10934700	61167456
3280410	30583728
2186940	———
———	367004736000
2525915700	Or,

Or, *You may Multiply by the significant Figures,* (neglecting the Cyphers (*as in the second Sum*) *as if there were none, only to the Product annex as many Cyphers as there were Cyphers in the Multiplier.*

Example 3. Where the *Multiplicand* and *Multiplier* have each of them Cyphers at the right hand.

(1)	(2)
58400	438700
760	67000
3504000	30709
408800	26322
44384000	29392900000

Or, *You may* neglect the Cyphers (*as in the second Sum*) *only to the Product annex as many Cyphers as there were Cyphers to the right hand of the Multiplicand and Multiplier.*

XIII. When the *Multiplier* consists of a Unite in the highest place towards the left hand, and all the rest Cyphers towards the right hand, as 10, 100, 1000, *&c.* Then is the whole Work performed by annexing the Cyphers of the *Multiplier* to the Figures of the *Multiplicand*; as in the following Examples.

6507	6507	6507
1000	100	10
6507000	650700	65070

XIV. *It is necessary for all such as would be dexterous and ready at Arithmetick, to learn to Multiply by these Compound Numbers following very readily at one Operation,* viz.

Ex. Mult. 574967	Mult. 842958
by 11	by 12
fa. 6324637	*fa.* 10115496
345786	859427
110	120
product 38036460	*fa.* 103131240
7504675	3217295
12	12
90056100	38607540

Here 574967 is multiplyed by 11 thus, 11 times 7 is 77, put down 7, and carry 7, and then 11 times 6 is 66, and 7 I carry is 73, put down 3, and carry 7, then 11 times 9 is 99, and 7 I carry is 106, put down 6, and carry 10, then 11 times 4 is 44, and 10 I carry is 54, put down 4, and carry 5, then 11 times 7 is 77 and 5 is 82, put down 2, and carry 8, then 11 times 5 is 55, and 8 I carry is 63, which put down, so the Product

duct of 574967 Mult. by 11 is found to be 6324637.

In like manner to Mult. 842958 by 12, say, 12 times 8 is 96, put down 6, and carry 9, then 12 times 5 is 60, and 9 I carry is 69, put down 9, and carry 6, and so proceed till you have gone through your Sum.

To Multiply any Number by 110, or 120, put down a Cypher, and Multiply as before.

Multiply	423760	Mult.	543760
by	1100	by	1200
prod.	466136000	*fa.*	652512000

The Proof of Multiplication.

XV. When you would prove the truth of your work in *Multiplication*, first, with your Pen make a Cross, and then add the Figures of the *Multiplicand* together, not considering their value as to the places they possess, but as if they were all Unites, casting away the Nines as often as may be, and put the last remainder on the left side of the Cross made for that purpose, then likewise add the Figures in the *Multiplier* together, casting away the Nines as often as may be, and put the last remainder on the right side of the Cross; then Multiply these two remainders

mainders one by another, and cast away all the Nines out of their *Product*, and put their *remainder* above the Cross; then add together the Figures of the *Product*, casting away the Nines as often as may be, and put the last remainder under the Cross, and then look if the Figure above the Cross, and the Figure below the Cross be equal, then is your Sum rightly performed, otherwise not.

As for Example: Let it be required to multiply 587464 by 465; when the work is finished, I find the Product to be 273170760, as by the following work appears.

```
      6            587464
    7 + 6             465
      6           -------
                  2937320
                 3524784
                2349856
                ---------
                273170760
```

Now to prove whether the work be rightly perform'd, I first make a Cross as you see above, and then begin to add the Figures of the *Multiplicand* together, saying, 5 and 8 is 13, cast away 9 and there rests 4; then 4 and 7 is 11, cast away 9 and there rests 2; then 2 and 4 is 6, and 6 is 12, cast away 9 and

and there remains 3; then 3 and 4 is 7, which I put down on the left ſide of the Croſs: Then I add together the Figures of the Multiplier, as I did thoſe of the Multiplicand, and the laſt remainder there is *6*, which I put on the right ſide of the Croſs; then do I Multiply theſe two Figures together which ſtand on each ſide of the Croſs, *viz.* 6 and 7, and their Product is 42, out of which I caſt the Nines as often as may be, and there remains 6, which I put on the top of the Croſs. But the eaſieſt way to caſt the Nines out of any Numbei, is to add the Figures together which conſtitute that Number, and their Sum is the remainder when the Nines are caſt away as often as may be, ſo in this Example the Nines are eaſily caſt out of 42 (which is the product of 6 by 7) for 42 is conſtituted of 4 and 2, whoſe Sum is *6*; but if the ſaid Sum chance to come to more than 9, caſt *9* out of it, and put down the remainder, ſo 8 times 7 is 56, the Sum of which Figures (5 and 6) is 11, out of which taking 9 there reſts 2, which is the true remainder when the Nines are caſt out of 56 as often as may be.

Now in this Example, having put the ſaid remainder 6 above the Croſs, I proceed to caſt away the Nine out of the Product, and there

there remains 6 likewise, which I put below the Cross, and because the Figure above and below the Cross are equal, *viz.* Each 6, I conclude the work to be truly performed.

But the true *Proof of Multiplication* is by Division, as shall be taught in that Rule, this way by casting away the Nines many times proving the work to be true, when it is absolutely false, but when it proveth not true this way, the Sum cannot be right.

CHAP. V.

Of DIVISION.

I. DIVISION *teacheth to Divide any given Number into as many equal parts as you please.* Or,

It is that by which we discover how often one Number is contained in another.

II. In Division there are always 3 Numbers certain, and a fourth accidental.

III. Of the 3 Numbers certain 2 are always given to find out a third, *viz.* The one of the Numbers given is to be *Divided*, the other Number given is that by which the first is *Divided*, and the Number found out is the *Quotient*, and discovers how often the one Number is contained in the other.

IV. And in this Rule are three Remarkable Numbers, *viz.* The *Dividend*, the *Divisor*, and the *Quotient*.

(1.) The *Dividend* is the Number given to be divided into equal parts.

(2.) The *Divisor* is the Number given by which the *Dividend* is to be divided, which declareth into how many equal parts the *Dividend* is to be divided.

(3.) The *Quotient* is the Number *Invented* by the Operation, and ſhews how often the *Divisor* is contained in the *Dividend*.

And the *Remainder* is the Number which remains after the *Division* is ended, which is uncertain.

As ſuppoſe 15 were given to be divided by 3, or 15 Shillings to be divided amongſt 3 Men, here 15 is the *Dividend*, 3 is the *Divisor*, and 5 is the *Quotient*, for 3 is contained in 15 juſt 5 times, without any remainder; but if you were to divide 20 by 3, the *Quotient* would be 6, and the *Remainder* 2, for 3 is contained in 20, 6 times, and 2 remains over.

In *Division* (*by one Figure*) you are firſt to write down the *Dividend*, and then draw a crooked line, and place the *Divisor* on the left hand thereof, then draw a line under the *Dividend*, under which place your *Quotient*.

Example.

Example. Let it be required to Divide 45 by 9, here the *Quotient* is 5, because 9 is contained in 45, five times, and these ought to be placed as followeth.

Dividend
Divisor 9) 45

Quotient 5

V. When a Number is given to be divided by a *single* Figure or *Digit*, if the first Figure of the *Dividend*, viz. (*that on the left hand*) be bigger, or at least equal to the *Divisor*, you are to put a Point or Prick under the same, and then proceed as followeth.

Example. Suppose it were required to divide 6776 by 4, the given Numbers are placed as before directed, making a Prick under (6) the first Figure of the *Dividend*, which for distinction sake may be called the *Dividual*, as followeth.

Dividend
Divisor 4) 6776

Quotient 1694

Note, In every *Division* you are to observe this Method; first, to *Seek*, secondly, to *Multiply*, thirdly, to *Subtract*.

As in the last Example, after you have writ down your *Dividend* and *Divisor*, as was shewed you, first, seek how often (or how many times) 4, which is the *Divisor*, can you have in 6, which is the first Figure of the *Dividend*.towards the left hand, the Answer is once; which 1 place in the *Quotient* exactly under the 6 (as you see in the Operation of the Sum) and say, once 4 out of 6, there will remain 2, which 2 is two Tens to the next Figure 7, and makes the new *Dividual* 27. Then ask again (*or seek*) how often 4, the *Divisor*, can you have in 27. *Answer*, 6 times, which 6 place in the *Quotient* under 7, the second Figure of the *Dividend*; then take 6 times 4 which is 24, out of 27, there will remain 3, which is three Tens to 7, the third Figure of the *Dividend*, and makes it 37. Then *ask* again, how many times 4 can you have in 37? Answer, 9 times; which 9 place in the *Quotient* under 7, the third Figure of the *Dividend*; then take 4 times 9, which is 36, out of 37, there will remain 1, which is one Ten to the fourth and last Figure of the *Dividend*, and makes the 6 to be 16. Then, *Lastly*, seek how often the *Divisor* 4 can you have in 16; Answer, 4 times, which I place under 6 the last Figure of the *Dividend*,

dend, and your work is done; the *Quotient* being found to be 1694, which is the number of times the *Divisor* 4 is found in the *Dividend* 6776. Or if the said Sum were to be divided between 4 Men, each Man's share would be 1694 pounds.

But to make this plain to any ordinary Capacity, I shall take the *Dividend* into pieces, to shew the four several Operations of the last Sum, and then give you some Examples for your Practice therein.

	Dividend						
Divisor	4) 6776						
		4)	6	27	37	16	
Quotient	1694						
			1	6	9	4	

If you take 1 time 4 out of 6, there will remain 2 to the second Figure 7, which makes it 27; then 4 in 27, there will be 6 times, and 3 will remain to the third Figure 7, which makes it 37; then 4 in 37, there will be 9 times, and 1 will remain to the fourth Figure, which is 6, and makes it 16; then 4 in 16, is 4 times, which place under 6, the last of your *Dividend*, and your *Quotient* will be 1694.

Examples

Examples for the Learners Practice.

(1)	(2)	(3)
5) 712640	6) 721494	7) 42165
142528	120249	6023 $\frac{4}{7}$

VI. *If you cannot take the Diviſor out of the Dividend,* as in the ſecond Example, then are you to put a Cypher in the Quotient, and reckon that Figure as ſo many Tens to the next Figure, as before was ſhewed you in the laſt Rule.

Example. 6) 721494

120249

Say, 6 in 7 once, reſt 1, which makes the 2, 12; then 6 in 12, 2 times; then 6 in 1, 0 times, reſt 1, which makes the 4, 14; then 6 in 14, 2 times, reſt 2, which makes the 9, 29; then 6 in 29, 4 times, reſt 5, which makes the 4, 54; then 6 in 54, 9 times, ſo the Quotient is 120249.

VII. *If after you have divided, there remains any thing,* that which remains is called a Fraction, and muſt be placed at ſome diſtance from the laſt Figure of the Quotient in a leſſer Character, then draw a ſmall ſtroke under it, and place your Diviſor under, as in the Examples following.

(4)	(5)	(6)
7) 54934	8) 316495	9) 314256
$7847\frac{5}{7}$	$39561\frac{7}{8}$	$34917\frac{3}{9}$

VIII. *To prove your Division,* Multiply your Quotient by the Divisor, to which add the remainder; if the Product be the same as your Dividend is, your work is true.

8) 85436	7) 364153	9) 314254
$10679\frac{4}{8}$	$52021\frac{6}{7}$	$34917\frac{1}{9}$
Proof 85436	364153	314254

To prove this last Example, where I Divide by 9, I Multiply 7, the Unite of my *Quotient*, by 9, the *Divisor*, which makes 63, and the remainder 1 added to it, makes it 64; so I put 4, and carry 6, and say, 9 times 1 is 9 and 6 is 15, 5 and carry 1; then 9 times 9 is 81 and 1 I carry is 82, 2 and carry 8; then 9 times 4 is 36 and 8 is 44, 4 and cary 4; then 9 times 3 is 27 and 4 is 31, which put down, so the Product is 314254, the Sum equal with the *Dividend*, which was to be proved.

IX. *But if the first Figure of the Dividend towards the left hand be lesser than the first Figure of the Divisor,* as in the fifth and sixth Examples

Examples of the ſeventh Rule; then make the two firſt Figures your Dividual, and proceed as before.

Other Examples of Diviſion by the foregoing Rules, with their Proofs.

9) 51376	11) 413795	12) 413271
Quot. $5708\frac{4}{9}$	$37617\frac{8}{11}$	$34439\frac{3}{12}$
Proof 51376	413795	413271

To Divide by 11, ſay, 11 in 41, 3 times, reſt 8, which makes the 3, 83; then 11 in 83, 7 times, reſt 6, which makes the 7, 67; then 11 in 67, 6 times, reſt 1, which makes the 9, 19; then 11 in 19, 1 time, reſt 8, which makes the 5, 85; then 11 in 85, 7 times, the remainder is $\frac{8}{11}$, ſo the Quotient is $37617\frac{8}{11}$.

And after this manner you may Divide any Number by 12, 120, or 1200, as in the following Examples, the Multiplication Table being ſo compoſed, as to aſſiſt you in the Multiplying and Dividing by 11 and 12 as readily as by any other ſingle Figure.

X. To Divide any Number by 10, 100, or 1000, as many Cyphers as you have in your *Diviſor*, cut off ſo many Figures from the Unite of your *Dividend*, as in the following Examples.

1|0)

1|0) 4150|7 1|00) 3142|67 100|0) 91|437

Quo. 4150 $\frac{7}{10}$ 3142 $\frac{67}{100}$ 91 $\frac{437}{1000}$

XI. *But if the Figure of the Divisor be more than a Unite, and Cyphers follow it,* in such case, as many Cyphers as you have in the Unites of your Divisor, cut off so many Figures from the Unite of your Dividend, and proceed to Divide as in single Figures.

	7|0) 5432|6	300) 84295|67
Quotient	776 $\frac{6}{70}$	28098 $\frac{167}{300}$
Proof	54326	8429567

Various Examples for the Learners Practice.

	11|0) 372145|6	12|0) 412678|5
Quotient	33822 $\frac{36}{110}$	34389 $\frac{105}{120}$
Proof	3721456	4126785
	11|00) 631496|75	12|00) 814653|70
Quot.	56499 $\frac{775}{1100}$	67887 $\frac{970}{1200}$
Proof	63149675	81465370

Division

Division *by two or more Figures* being the hardest Lesson in Arithmetick, must be heedfully attended by the Learner, for whose ease I shall endeavour to make the way smooth, both by Rules and Examples.

XII. *When the Divisor consisteth of more places than one*, then you are to set out so many figures on the left hand of the Dividend for a Dividual, and then put a point under that figure of the Dividual which stands next to the right hand.

Then seek how often the first figure towards the left hand of the Divisor, is contained in the first figure towards the left hand of the said Dividual, and place the Answer in the Quotient.

Then Multiply the whole Divisor by the said figure so placed in the Quotient, and place the Product in order under the Dividual.

Which being done, subtract the said Product from the Dividual, placing the remainder below the line.

Then put a point under the next figure of the Dividend, and annex it to the remainder, so have you a new Dividual, with which you are to proceed as is before directed.

Example

Example 1. Let it be required to Divide 8904 by 42. Here the given Numbers being diſpoſed of according to the fourth Rule of this Chapter, will ſtand as followeth.

42) 8904 (

Then becauſe there are 2 places in the Diviſor, I take the two firſt figures on the left hand of the Dividend for a Dividual, which is 89, putting a point under the 9, which is that figure of the Dividual which ſtands next the right hand.

Then I ſeek how often the firſt figure (4) of the Diviſor, is contained in the firſt figure (8) of the Dividual, and the Anſwer is 2 times, wherefore I put 2 in the Quotient, and thereby I multiply the Diviſor 42, and the Product is 82, which I place in order under the Dividual 89, and Subtract it therefrom, and the remainder is 5.

Then I put a point under the next place; which is (0), and annex it to the ſaid remainder 5, and it makes 50 for a new Dividual, and then the work will ſtand as followeth.

```
42) 8904 (2
    84
    ---
     50
```

In

In the next place I ſeek how often I can have the firſt Figure of the Diviſor (which is 4) in the firſt Figure of the Dividual 50 (which is 5) and the anſwer is 1 time, wherefore I put 1 in the Quotient, and thereby multiply the Diviſor 42, and the Product is 42, which I place in order under the Dividual 50, and ſubtract it therefrom, and the remainder is 8, which I place under the line, and thereto annex the next Figure of the Dividend, which is 4, (having firſt put a point under it) and it makes 84 for a new Dividual, and then the work will ſtand as followeth.

```
42) 8904 (21
     ...
    84
   ----
     50
     42
   ----
      84
      84
   ----
       0
```

Then I again ſeek how often the firſt Figure of the Diviſor (which is 4) is contained in the firſt Figure of the Dividual (which is 8) and the anſwer is 2 times, wherefore I put 2 in the Quotient, and thereby multiply the Diviſor 42, and the Product is 84, whihc I place orderly under the Dividual 84, and

Subtract it therefrom, and there remains o. So is the Operation ended, and I find that 8904 being divided by 42 the Quotient is 212, as by the foregoing Operation appeareth.

XIII. *When you have multiplied the Divisor by the Figure placed in the Quotient,* if the Product chance to be greater than the Dividual, then you may be sure that the Figure placed in the Quotient is too much; wherefore is such case you must cancel that Figure, and in the room thereof put one that is less by an unite, and if the Product be yet bigger than the Dividual, place yet a lesser Figure than that in the Quotient, and then proceed as has been before directed.

Example 2. Let it be required to divide 7868 by 37. The given Numbers being placed according to former direction, I begin the work, and first I seek how often I can have 3 (the first Figure of the Divisor) in 7 the first Figure of the Dividual 78, (having before put a point under the 8,) and the Answer is 2 times, wherefore I put 2 in the Quotient, and thereby multiply the Divisor 37, and the Product is 74, which being Subtracted from the Dividual 78, there remains 4, to which having annexed the next Figure of the Dividend (6) it makes 46 for

a

a new Dividual. Then I proceed to ſeek how often 3 is contained in 4, and the anſwer is 1 time, wherefore I put 1 in the Quotient, and thereby multiply the Diviſor 37, and the Product is 37, which being Subtracted from the Dividual 46, the remainder is 9, to which the next Figure of the Dividend being annexed, *viz.* 8, it makes 98 for a new Dividual. Then I proceed to ſeek how often I can have 3 in 9, and the anſwer is 3 times, wherefore I put 3 in the Quotient, and thereby I multiply the Diviſor 37, and the Product is 111, which is more than the Dividual, whereby I perceive that I have put a Figure too big in the Quotient; therefore according to the directions given in the foregoing Rule, I cancel the 3, and inſtead thereof I place a 2, and then multiply the Diviſor thereby, and the Product is 74, which is leſſer than the Dividual, wherefore I make Subtraction and there remains 24; and ſo having never another Figure to bring down from the Dividend, I conclude the work to be ended, and the Quotient tus found is 212, as by the following Operation appears.

```
                 2
37) 7868 (21~~3~~
     ...
     74
     ---
      46
      37
      ---
       98
      xxx
       74
      ---
Remainder (24)
```

And here note, That if at any time it so happens that after you have multiplied the Divisor by the Figure last placed in the Quotient, and Subtracted the Product from the Dividual, if the Remainder be greater than the Divisor, the Figure last placed in the Quotient is too little, and therefore it must be cancelled, and a bigger Figure placed in its room. What is to be done with the remainder after Division is ended shall be shewed in its due place, but only for the present let it suffice to understand that it is the Numerator of a Fraction which is part of the Quotient, the Divisor being the Denominato to the same: So the true Quotient of the last Division is $212\frac{24}{37}$. But more of this hereafter.

XIV. *When* (according to the directions given in the last Rule) *you have assigned your*

your Dividual to consist of as many places as the Divisor containeth places, if then the Dividual be less than the Divisor, (so that the Divisor cannot be Subtracted therefrom) you are then to annex another Figure thereto, so that then it will consist of one place more than the Divisor hath places, and then you are to seek how often the first Figure of your Divisor is contained in the two first Figures of the Dividend; and then proceed according to the Rules before delievered.

The like is to be observed in the middle of your work if the Dividual chance to consist of one Figure more than the Divisor, as in the following Example.

Example 3. Let it be required to divide 4763585 by 587. Here because the Divisor 587 consisteth of 3 places, therefore I should take the 3 first Figures to the left hand of the Dividend for a Dividual, which is 476, but because 476 is lesser than the Divisor 587, I therefore put another Figure thereto, and then I have 4763 for a Dividual, and having first put a point under the Figure 3, I begin the Division, and first I seek how often 5 (the first Figure of the Divisor) is contained in 47 (the two first Figures of the Dividend) which I find to be 9 times, but having tryed according to the Thirteenth Rule of this

Chapter) I find 9 is too much, but it will bear 8, wherefore I put 8 in the Quotient, and having multiplied the Divisor thereby, and Subtracted the Product from the Dividual, according to the direction given in the Twelfth Rule of this Chapter, I find the remainder to be 67, to which I annex the next Figure of the Dividend, which is 5, having first put a point under it (according to the said Twelfth Rule) and then I have 675 for a new Dividual. Then I seek how oft 5 (the first of the Divisor) is contained in 6 (the first of the Dividend) and the answer is 1, which I put in the Quotient, and having Multiplied and Subtracted, I find the remainder to be 88, to which annexing the next Figure in the Dividend, it makes 888 for a new Dividual, then I seek, &c. And after Subtraction, there is a Remainder of 301, to which annexing the next and last Figure of the Dividend, which is 5, it makes 3015 for a Dividual, which consisteth of one place more than the Divisor, therefore according to the latter part of the Fourteenth Rule, I seek how often 5 is contained in 30, and by Tryal according to the Tenth Rule, I find it will bear 5 times, wherefore I put 5 in the Quotient, and having Multiplied and Subtracted, I find the

the Remainder to be 80, and the work is ended, and I find the Quotient to be $8115\frac{80}{587}$. See the following work.

```
587) 4763585 (8115
        ....
     4696
     ----
      675
      587
      ----
       888
       587
       ----
       3015
       2935
       ----
Remainder (80)
```

Examp. 4. Divide 72164375 by 9437.

```
9437)    66059... (7645.
         --------
          61053
          56622
         --------
           44317
           37748
          -------
            65695
            56622
          -------
Remainder   9073
```

Thus have I run through one sort of Division, and I hope that by this time the Learner is able to Divide any Number given, and here let him take notice once for all, that there must never be brought down

but one Figure or Cypher at one time from the Dividend, to be annexed to the Remainder for a new Dividual, and for every ſuch Figure or Cypher ſo brought down, there muſt be a Figure or Cypher put in the Quotient.

I might give you many more Examples of Diviſion, wherein the Diviſor may conſiſt of 4, 5, 6, 7, 8, 9, 10, *&c.* places, but the Method being the very ſame with what is before delivered, I ſhall therefore forbear, and only admoniſh the Learner to be perfect in the foregoing Rules, and to practice well the Examples therein delivered; and for further Practice, I ſhall lay down the operation of two other Examples, and then give you the Quotients of four other Examples, but ſhall omit the Operation as a whetſtone for the Learners Ingenuity.

Likewiſe if you divide 2459337766 by 38462, the Quotient will be 63942, and the Remainder after the work is finiſhed is 562.

And if you divide 4926735806877 by 5846793, the Quotient will be 842639, and there will be a Remainder of 150.

Or if you divide 1079245884216 by 1998573, the Qutoient will be 540008, and there will be a Remainder of 475632.

Alſo

Alſo if you divide 2395096414141498 by 297864, the Quotient will be 10409063, and there will be a Remainder of 60.

There is yet a much ſhorter (way of) Diviſion, by omitting to ſet down the Multiplication of your Diviſor, (as is done in the foregoing Examples) and in this you *Multiply* and *Subtract* together: In which *Way* the *Quotient* is placed under the *Diviſor*, as being moſt ready and convenient for the working of any Sum. And being the moſt *accurate* and ready *way* of *Diviſion*, I ſhall purſue this Method through the remaining part of this Book, after I have given three or four Examples of one and the ſame Sum divided by both ways for the Learners eaſe and Practice.

Let us Divide the two laſt foregoing Sums by this ſhort *Italian* way of Diviſion. *viz.* the third and fourth Example.

Firſt of all, Let it be required to Divide 4763585 by 587. being the third Example.

Firſt, I proceed and ask the Queſtion, as was ſhewed you in the third Example of this Rule, and ſay, how often 5, the firſt figure of the Diviſor, can I have in 47, the firſt figures of the Dividend? Anſwer, 8 times. Then Multiply 7, the Unite Figure of your Diviſor, by 8, the figure which you bring in your Quotient, and ſay, 8 times 7

is 56, out of 3 (the fourth figure of the Dividend) I cannot, but 56 out of 63, rest 7, and carry 6 to the second figure of the Divisor. Then Multiply again, and say, 8 times 8 is 64, and 6 I carried is 70, out of 6 I cannot, but 70 out of 76, rest 6, and carry 7 to the first figure of the *Divisor*; then Multiply again, and say, 8 times 5 is 40, and 7 I carried is 47, out of 47, rest 0. So that by this Operation you find after 8 times 587 is taken out of 4763, there will remain 67, to which I take down 5, the next figure of my Dividend, for a new Dividend.

$$\begin{array}{l l} 587) & 4763585 \\ \hline 8 & \quad 675 \end{array}$$

Then I proceed again, and say, how often 587 (my Divisor) can I have in 675, my Dividend? The Answer is once, which 1 I put in the Quotient, and Multiply as before, and say, once 7 out of 5 I cannot, but 7 out of 15, rest 8, and carry 1; then once 8 is 8, and 1 is 9, 9 out of 7 I cannot, but 9 out of 17, rest 8, and carry 1; then once 5 is 5, and 1 I carry is 6, 6 out of 6, there rests (0) which I omit to place down, because a (0) on the left hand is insignificant: Then to the Remainder 88

I

I take down 8, the next figure of my Dividend, and it makes my new Dividend 888.

```
 587) 4763585
 81     675
          888
```

Then I proceed again, and ask, how often 587, my Divisor, can I take out of 888, my Dividend, the answer is once, which 1 I put in the Quotient, and say, once 7 out of 8, rest 1; then once 8 is 8, 8 out of 8, rest 0, then once 5 out of 8, rest 3; so the Remainder of that Division is 301, to which I take down 5, the next figure of my Dividend, which makes my new Dividend 3015.

```
 587) 4763585
 811    675
        888
        3015
```

Then I proceed and ask again, how often 587 I can have in my last Dividend 3015; the Answer is 5 times, which 5 I place in my Quotient, and Multiply as before, and say, 5 times 7 is 35 out of 5 I cannot, but 35 out of 35, rest 0, and carry 3; then again, 5 times 8 is 40, and 3 I carry is 43, out of 1 I cannot, but 43 out of 51, rest 8, and

and carry 5; then laſtly, 5 times 5 is 25, and 5 I carry is 30, 30 out of 30, reſt 0. So my *Remainder* of this laſt Diviſion is 80, which I cut off with a ſtroke from the reſt of the work, to ſignifie it to be a *Remainder*, and my whole Operation of the Sum ſtands as followeth.

Example 1. Dividend.

```
Divisor   587) 4763585
Quotient  8115    675
                  888
                 3015
                 ----
                   80 Remainder.
```

Example 2. Divide 72164375 by 9437.

```
     9437)         61053
Quotient 7646       44317
        56622       65695
                   ------
        37748        9073
       56622
      66059
  -----------
     72155302
         9073
  -----------
     72164375
```

Proof, is to Multiply the Quotient by the Diviſor, and to the Product add the Remainder.

Examples

Examples of the short Italian *way of Division, for the Learners Practice, with their Proofs.*

```
        297546)   148975182883 5
                          ......
Quot.   5006795        02021828
         297546         2365528
       30040770         2827063
       20027180         1491495
      35047565            03765
     45061155
    10013590
    14897518250 70
           3765 Remainder.
    148975182883 5 Proof.
```

The same Examples after the long Italian *way of Division, with their Proof.*

```
297546) 148975182883 5 (5006725
        1487730 .....
            2021828
            1785276
             2365528
             2082822
              2827063
              2677914
               1491495
               1487730
Remainder      3765
```

To Prove Division.

1. Multiply your Quotient by your Divisor (and to the Product add your Remainder, if any be) the Sum of all added together will be equal to your Dividend, if your work be true. Or,

2. You may take the several Products that are placed under each *Dividual* (in this way of Division) and place them in the same order as they there stand in respect to one another, and to their Sum add the Remainder, and the *Proof* will stand as followeth.

```
1487730
  1785276
   2082822
    2677914
     1487730
        3765 Remainder.
148975182883 5 Proof.
```

O R,

You may also prove Division by casting out the Nines thus.

First, make a Cross, then cast the Nines out of your Divisor, and place the remainder on the left side of the Cross. Then cast the Nines out of your Quotient, and place the remainder opposite to the other on the right

right side of the Cross; Multiply these two figures together, and out of your Product cast the Nines, the overplus carry to the remainder, and continue to cast out all the Nines therefrom, and the remainder above Nine place on the top of the Cross. Lastly, cast the Nines out of your Dividend, and if that remainder comes to be the same figure with that placed on the top, your Sum is true; then place that last figure at the bottom of your Cross.

But the most certain Proof of *Division* (as I shewed before) is by *Multiplication*; and the most certain Proof of *Multiplication* is by *Division*, they inteachangeably proving each other.

For if you divide the *Product* by the *Multiplicand*, the *Quotient* will be equal to the *Multiplier*.

If you divide the *Product* by the *Multiplier*, the *Quotient* will be equal to the *Multiplicand*.

An Example or two will make this Proof of Division plain.

(1)
Dividend (2)
Divisor 754) 912673 457) 159137
Quot. 1210 1586 348 2233
787 3757
333 101

In

In the first of these two last Examples my Divisor is 754, Quotient is 1210, Remainder is 333, and Dividend 912673 *To prove which*, make a Cross, as in the Margent: Then cast the Nines out of the Divisor, there will remain 7, which I place on the left side of the Cross, then cast the Nines out of the Quotient, rest 4, Multiply 7 by 4, it makes 28, cast out the Nines, rest 1, which I carry to the remainder, and say, 1 and 3 is 4, and 3 is 7, and 3 is 10, cast out 9, rest 1, which I place above the Cross.

$$\begin{array}{ccc} & 1 & \\ 7 & + & 4 \\ & 1 & \end{array}$$

Lastly, cast the Nines out of your Dividend, and there will rest 1, which place under the Cross, and your Sum is true.

XV. When the *Divisor* consisteth of any other Number with a Cypher or Cyphers annexed thereto, then cut off the Cyphers of the *Divisor* with a dash of the Pen, & as many Cyphers as you cut off from the *Divisor*, so many places must you cut off from the *Dividend*; then proceed to Divide the remaining figures of the *Divisor*, as if there were no such Cyphers or Figures in the *Divisor* or *Dividend* as you cut off, and if nothing remain after *Division* is ended, then shall the figures you cut off from the given *Dividend* be the true remainder; but if any

thing

thing do remain after *Diviſion* is ended, you are thereto to annex the figures of the *Dividend* that were before cut off, ſo ſhall the ſaid remainder with the figures annexed thereto be the true remainder.

Example. Divide 486793 by 15000. Firſt, I cut off the three Cyphers of the *Diviſor*, and alſo three places of the right hand of the *Dividend*, ſo have I 15 for my Diviſor, and 486 for my Dividend, *viz.*

```
15|000) 486|793 (32
        45
        ---
         36
         30
         ---
          6
```

The ſame the ſhort way of Diviſion.

```
15|000) 486|793
-------
  32     36
        ----
          6
```

Here I find the *Quotient* to be 32, and the Remainder is 6, to which annexing the figures cut off from the *Dividend*, *viz.* 793, it makes 6793 for the true Remainder.

Having thus enlarged and finiſhed the firſt Fundamental Rules of Arithmetick, their Application ſhall be more particularly taught in the following Chapters.

CHAP.

CHAP. VI.

Of REDUCTION.

I. REDUCTION *Teacheth to Reduce Numbers, whether Money, Weight, Measure, Time, Motion, &c. from once Denomination to another, dicovering the ſame value, but in different Terms.*

II. The whole Work of Reduction is performed by Multiplication and Diviſion.

III. All great Denominations are brought into leſſer of the ſame value by Multiplication, and this is by ſome called *REDUCTION DESCENDING.*

IV. All ſmall Denominations are reduced into greater of the ſame value by Diviſion; and this is by ſome called *REDUCTION ASCENDING.*

V. *To Reduce greater Denominations into leſſer of the ſame value,* Conſider how many of the *Leſſer* are equal to one of the *Greater*, and multiply the given Number thereby, ſo ſhall the Product be the Anſwer to the Queſtion.

Example.

Example. *Reduce* 3468 *Shillings into Pence.* Here I consider that 12 *Pence* is a *Shilling*, and the *Pence* ought to be 12 times the number of *Shillings*, wherefore I Multiply by 12 at one Opreation, according to the Fourteenth Rule of the fourth Chapter, and the Product is 41616 *Pence*, as in the Margent.

$$\begin{array}{rr} & 3468 \\ & 12 \\ \hline \textit{fa.} & 41616 \text{ pence.} \end{array}$$

VI. *To Reduce Smaller Denominations into Greater*, Consider how many of the *Smaller* are equal to one of the *Greater*, and Divide thereby, the Quotient is the Answer to the Question.

Example. *Reduce* 41616 *Pence into Shillings.* First, consider that 12 *Pence* is a *Shilling*, and that the *Shillings* ought to be a twelfth part of the *Pence*; wherefore I Divide the given Number by 12 at one Operation, as was shewed you in the Eleventh Rule of the Fifth Chapter, and say, 12 in 41, 3 times, rest 5 to the 6, makes it 56; then 12 in 56, 4 times, rest 8, which makes the 1, 81; then 12 in 81, 6 times, rest 9, which makes the 6, 96; then 12 in 96, is 8 times, and the Quotient gives me 3468 *Shillings*, which is the Answer to the Question, and may

$$\begin{array}{rr} 12) & 41616 \\ \hline \textit{fa.} & 3468 \text{ Shill.} \end{array}$$

serve

ſerve for a Proof of the foregoing Example.

Note, I would Adviſe the Learner to inure himſelf to the moſt ſhort and ready ways of Multiplication and Diviſion, which will very much contract the Operations in Reduction, *viz.* In Reduction of Money, to Multiply the *Shillings* by 12 at one Operation, as in Chap. 4. of Multiplication, Rule 14. And likewiſe to Divide by 12 at one Operation, as in the 9*th.* and 11*th.* Rules of the fifth Chapter.

For your further aſſiſtance in Reduction, you ought to have reſpect to the Tables of *Coin, Weight, Meaſure, &c.* delivered in the ſecond Chapter.

Example 1. *In* 685 l. *I demand how many Shillings, Pence, and Farthings?*

685 *Pounds.*
20
13700 *Shill.*
12
164400 *Pence.*
4
fa. 657600 *Farth.*

First, I Multiply by 20 (becauſe 20 *Shillings* is a *Pound*) and the Product is 13700 *Shillings*, then I multiply the *Shillings* by 12, (becauſe 12 *Pence* is a *Shilling*) and the Product is 164400 *Pence*, then I multiply the *Farthings* by 4, (becauſe 4 *Farthings* is a *Penny*) and the Product is 657600 *Farthings*, as in the Margent. This

This or any other number of *Pounds* might be reduced into *Pence* or *Farthings* at one Operation, without reducing it into the intermediate Denominations.

For if you multiply *Pounds* by 240 (because ſo many *Pence make a Pound*) the Product will be *Pence*; and if you multiply *Pounds* by 960, (becauſe 960 *Farthings* is a *Pound*) the Product will be *Farthings*: So in the foregoing Example 685 *l.* being multiplied by 240, the Product you will find to be 164400 *Pence*; and if you multiply 685 *l.* by 960, the Product will be 657600 *Farthings*, for the Reaſons before ſaid.

But you may ſay, you cannot well remember how many *Pence* or *Farthings* make a *Pound*, I will therefore teach you how to find it out at any time when you have occaſion. You may eaſily remember that 20 *Shillings* is a *Pound*, and that multiplied by 12 produceth 240 *Pence*, which being multiplied by 4 produceth 960 *Farthings*, as in the Margent.

20	*Shill.*
12	
240	*Pence.*
4	
960	*Farth.*
one Pound.	

Example 2. *In* 657600 *Farthings I demand how many Pence, Shillings, and Pounds?*

This Queſtion is the Reverſe of the former, and may ſerve for a Proof thereof: Firſt,

First, I divide the *Farthings* by 4, and the *Quotient* is 164400 *Pence*, then I divide the *Pence* by 12, and the *Quotient* is 13700 *Shillings*, and the *Shillings* I divide by 20, and the *Quotient* is 685 *Pounds*, which is equal to the given Number in the first Example. See the whole Operation as followeth:

4)	657600	*Farthings.*
12)	164400	*Pence.*
2|0)	1370|0	*Shillings.*
Facit	615	*Pound.*

VII. *When in Reduction Descending*, the Number propounded to be reduced, consisteth of divers Denominations, as of *Pounds*, *Shillings*, *Pence*, and *Farthings*; or of *Pounds*, *Ounces*, *Penny-weights*, and *Grains*, *&c.* then you may readily reduce it into the lowest Denomination, thus; when you reduce an higher Denomination into the next inferiour, add to the Product the expressed parts into which you reduce it, as if you were to reduce *Pounds* into *Shillings*, add to the Product (as you multiply) the *Shillings* that are expressed in the Number propounded; proceed in the same method till ye have reduced the given Number into the Denomination required, as in the following Example.

Example

Example 3. *Reduce* 567 l.--15 s.--6 d. $\frac{1}{4}$. *into Farthings.*

First I multiply by 20 to bring into *Shillings*, ſaying, 0 times 7 is 0, but 5 is 5, (taking in the 5 that is in the place of Unites in the *Rank of Shillings*, and ſetting it in the place of Units in the Product;) then 2 times 7 is 14, and 1 is 15, (taking in the 1 that is in the place of Tens in the *Rank of Shillings*) ſo I ſet down 5 in the place of Tens in the Product, &c. the Product is 11355 *Shillings*; then I multiply the *Shillings* by 12 to bring them into *Pence*, ſaying, 2 times 5 is 10, and 6 is 16, (taking in the 6 that ſtands in the *Rank of Pence*,) &c. and the *Pence* make 136266; then I multiply my *Pence* by 4 to bring them into *Farthings*, ſaying, 4 times 6 is 24, and 3 is 27, (taking in the 3 which ſtands in the *Rank of Farthings*,) &c. ſo the *Farthings* amount to 545067, as by the whole Operation appeareth.

567 *l.*—15 *s.*—6 *d.* $\frac{1}{4}$.
20
11355 *Shillings.*
12
136260 *Pence.*
4
545040 *Farthings.*

Obſerve the like in any other Example.

VIII.

VIII. *When in Reduction Ascending* any thing remains after Division is ended, it is always of the same Denomination with the Dividend, as in the following Example.

Example 4. *In* 545067 *Farthings I demand how many Pounds?*

First, I divide the given Number of *Farthings* by 4, and the *Quotient* is 136266 *Pence*, and there remains 3, which is 3 *Farthings*, because the Dividend was *Farthings*.

Then I divide the *Pence* by 12, and the *Quotient* is 11355 *Shillings*, and there remaineth 6, which is 6 *Pence*, because the Dividend was *Pence*.

Then I divide the *Shillings* by 20, and the *Quotient* is 567 *l.* and there remaineth 15, which is *Shillings*, because the Dividend was *Shillings*: So that I find by the work, 545067 *Farthings* to be 567 *l.*—15 *s.*—6 *d.* ¼. as by the following work.

4) 545067
12) 136266 ¾
2|0) 1135|5 : 6 *d.*
Facit lb. 567 15 *s.* 6 *d.* ¾.

This Question is the inverse of the *third Example*, and may very well serve for a Proof thereof, as you may observe at your Leisure.

Here

Here by the way take notice that when you are (to Divide any Number by 20, that is) to bring *Shillings* into *Pounds*, the best way is to cut off a Figure to the right hand for *Shillings*, and then to take half the Figures to the left hand for *Pounds*, and if one remain it is 10 *Shillings* to be added to the figure first cut off. For *Example*:

Were 11355 *Shillings to be reduced into Pounds*; I cut off the last figure 5 for *Shillings*, and say, half of 11 is 5, half of 13 is 6, half of 15 is 7, and there remains 1, which makes the 5 *Shillings* to be 15 *Shillings*; and this Method shall be observed hereafter.

1135|5	*s.*	*d.*
fa. 567 :	15	— 0

NOTE once for all, That Reduction *Ascending* proves Reduction *Descending*, the one being a Reverse to the other, as shall be demonstrated in the ensuing Questions that follow over leaf in all the varieties of Reduction.

In 7642 l. 17 s. 11 d. $\frac{1}{8}$ *I demand how many half Farthings.*

$$\begin{array}{r} 20 \\ \hline 152857 \text{ Shill.} \\ 12 \\ \hline 1834295 \\ 8 \\ \hline fa.\ 14674361 \text{ half Farthings.} \end{array}$$

Tun. C. *qr.* ℔.

Quest. 1. *In* 95 : 11 : 3 : 15 *how many pound* (*weight?*

Averdupois Weight.

```
      20
    ----
    1911 hundred.
       4
    ----
    7647 quarters.
      28
   -----
   61181
   15295
  ------
Facit 214131 pound weight.
```

C. *qr.* ℔. *oz.*

Quest. 2. *In* 50 : 2 : 15 : 9 *how many Ouncès?*

```
      4
    ---
    202
     28
   ----
   1621
    405
   ----
   5671
     16
  -----
  34035
  5671
  -----
fa. 90745 Ounces.
```

By this you see that if 50 C. 2 *qrs.* 15 ℔. 9 *oz.* be *Multiplied* according to the Directions given in the *7th.* Rule of this Chapter, the Product will be 90745 Ounces, which is the Reverse or Proof of the second Question opposite to this on the right hand.

Quest.

Queſt. 1. *In* 214131 *pound weight how (many Tuns?*

28) 181
4) 7647 133
2|0) 191|1 ¾ 211
15 *pound.*

Proof 95 : 11 : 3 : 15. By this you ſee that if 214131 pound weight be *Divided* by 28, by 4, and 20, it will produce 95 *Tun,* 11 *C.* 3 *qrs.* 15 ℔. which is the Reverſe of the firſt Queſtion on the left hand.

Queſt. 2. *In* 90745 *Ounces how many (C. weight?*

16) 107
28) 5671 114
4) 202 71 25
15 9 *Ounces.*

50 : 2 : 15 : 9 Proof.

oz. pw. gr.

Quest. 3. *In* 507--10--11 *how many Grains*
Troy 20 *(of Silver?*
weight. 10150 *penny weight.*
24
40601
20301
fa. 243611 *Grains.*

Tun hh. Gall.

Quest. 4. *In* 54—2—25 *how many Quarts*
Liquid 4 *(of Wine?*
Measure. 218 *hhead.*
63
659
1310
13759 *Gallons.*
4
Proof 55036 *Quarts.*

Last. qr. bush. gall.

Quest. 5. *In* 75—5—3—2 *how many Gal-*
Dry 10 *lons of Wheat?*
Measure. 755 *Quarters.*
8
6043 *Bushels.*
8
fa. 48346 *Gallons.*

Quest.

Queſt. 3. *In* 243611 *Grains how many Ounces of Silver?*

```
         24) 036
2|0) 1015|0   121
Proof  507 : 10 pw. 10 Grains.
```

Queſt. 4. *In* 55036 *Quarts how many Tun of Wine?*

```
      4)
     63) 13759
  4) 218   115
     54    529
           25 Gall.
   fa. 54 : 2 hh. 25 Gall.
```

Queſt. 5. *In* 48346 *Gallons how many Laſt of Wheat?*

```
     8)
     8) 6043 : 2
   10   75|5 : 3
  Proof  75 : 5 : 3 : 2
```

By the foregoing Examples the Learner may be ſufficiently inſtructed in the working and proving any Sum in *Reduction.* I ſhall forbear to give you any more Examples of this Nature, my deſign being to improve the remaining Paper with Matter more uſeful, after I have given three or four more Examples in *Cloth Meaſure*, and *Reduction of Time.*

Cloth Measure.

Quest. 6. *In 207 Ells, 2 quarters 2 Nails, how (many Nails?*

5
1037 *Quarters.*
4
fa. 4150 *Nails.*

Quest. 7. *In 107 Yards, 3 Quarters, 1 Nail, (how many Nails?*

4
431 *Quarters.*
4
fa. 1725 *Nails.*

Quest. 8. *In 312 Ells Flem. 2 qrs. how many (Quarters?*

3
fa. 938 *Quarters.*

Quest. 9. *In 112 Aulns, 1 qr. 2 Nails, how ma- (ny Nails?*

6
673 *Quarters.*
4
fa. 2694 *Nails.*

Long

Long Measure.

Quest. 10. *The Circumference of the Earth being* 360 *Degrees, and every Degree* 60 English *Miles, I demand how many Miles, Furlongs, Perches, Inches, and Barly-Corns will reach round the World?*

360	*Degrees.*
60	*Miles a Degree.*
21600	*Miles about the Earth.*
8	
172800	*Furlongs about the Earth.*
40	*Perches in a Mile.*
6912000	*Perches about the Earth.*
33	*Half Feet in a Perch.*
20736000	
20736000	
228096000	*Half Feet about the Earth.*
6	*Inches in a half Foot.*
1368576000	*Inches.*
3	*Barly-Corns in an Inch.*
4105728000	*Barly-Corns about the Earth.*

Quest. 11. *I demand how many Days, Hours, and Minutes it is since the Birth of our Saviour Jesus Christ, to this present Year 1694.*

1694	*Years.*	
365	*Days in a Year.*	
8470		
10164		
5082		
618310	*Days since the Birth of Christ.*	
24	*Hours in one day.*	
2473240		1694
1236620		6
14839440		10164 *hours*
10164	*hours added.*	*to be added.*
14849604	*Hours since the Birth of Christ.*	
60	*Minutes in an hour.*	
890976240	*Minutes since the Birth of Christ.*	

Note, That 6 Hours is lost in every Year, to Correct which, you Multiply the Number of Years to be reduced by 6, and the Product will give you the Hours to be added to the given Time, as you may see in the Example above.

RE-

REDUCTION (according to the first Rule of this Chapter) Teacheth you also to Reduce the Coyns, Weights, and Measures of one Country into the Coyns, Weights, and Measures of any other Country. As for Example,

Quest. 1. *I have bought 3507 Ells* Flemish *of Genting Cloth, I would know how many Ells* English *is contained therein.*

The most Practical way to work this, is to Multiply the Ells *Flemish* by 6, and Divide by 10, which contracts the Work, because to Divjde by 10, is only to cut off the last figure of the Dividend. And the Reason is this, there is 6 half Quarters of a Yard in an *Ell Flemish*: And there is 10 half Quarters of a Yard in an *Ell English*; the Work stands, *viz.*

$$\begin{array}{r} 3507 \\ 6 \\ \hline 2104|2 \end{array}$$

Ells Engl.
fa. 2104 $\frac{2}{10}$, *which is equal to* $\frac{1}{5}$ *the quarter of an* Ell English.

Quest. 2. *In* 4215 $\frac{1}{2}$ *Ells Flem. how many Ells* (*English?*

$$\begin{array}{r} 6 \\ \hline 2529|3 \end{array}$$

Ells Eng.
fa. 2529 & $\frac{3}{10}$, *or three half quarters.*

Queſt. 3. *Is 295 Ells Engl. how many* Portu-(gal *Veres of 15 Nails?*

```
        295
         20
15)    5900
193    140
        50      Veres
         5   fa. 393 5/15.
```

Queſt. 4. *In 205 Piſtols, at 17 s. 6 d. how many pound Sterl.*

```
            205          17  6
            210          12
           2050         210
           410
24|0)  4305|0  Pence in all the Piſtols.
179    190
       225
         9     fa. 179 l. and 90 Pence.
```

Queſt. 5. *In an Ingot of Silver, quantity* 24 ℔. 7 *oz. how many Salvers, quantity* 12 *oz.* ½?

```
          ℔.  oz.
          24  7
          12              12 ½
         295              25
           2
25)      590  half Ounces.
23        90
          15   fa. 23 Salvers, and 15 half
                   Ounces.
```

Queſt.

C. qr. ℔.
Quest. 6. *In* 142—3—19 *of Sugar, how many*
4 (*Boxes of* 84 ℔?
571
28
4577
1143
84) 16007 *pound weight.*
190 760
47 *Boxes.* ℔.
fa. 190 *and* 47 *of Sugar.*

Quest. 7. *In* 35*l.*11*s.*4*d. how many Dollars at*
20 4*s.* 6*d.*
711 12
12 54
54) 8536
158 313
436
4 *fa.* 158 *Dollars &* 4 *Pence.*

Quest. 8. *In* 75 *Hogsheads of Wine how many*
63 (*Runlets of* 22 *Gallons?*
225
450
22) 4725
214 32.
105 *Runl.*
17 *fa.* 214 *and* 17 *Gallons.*

Quest.

Queſt. 9. *In* 905 *Guynea's, at* 21 s. 10 d. $\frac{5}{8}$ *how many Piſtols, at* 17 s. 6 d.

```
              s.  d.            s.  d.
     905——21: 10⅝——17: 6
    2101        12               12
    ————      ————           ————
     905       262              210
    9050         8                8
              ————          ————
   1810      2101            1680
   ————
168|0) 1901 40|5
——————
1131    221
        534
        300     Piſtols.
        ————
        132 fa.  1131 and 132 half Farth.
```

Queſt. 10. *Bought at* Bourdeaux 10 *Pieces of Pruans, quantity* 95 *Quintals, I demand how many* C. *weight it makes in* London?

```
     95          Note, 100 lb. is a Quintal.
    100
   ————
112) 9500
————
 84   540        C.   lb.
     ————
      92 fa.   84—92 in London.
```

Queſt.

Queſt. 11. *A Merchant at* London *Receives an Invoyce from his Correſpondent at* Jamaica *of ſeveral Hogſheads of Sugar, quantity* 195 C. 1 qr. 16 lb. *at* Jamaica, *I demand what Weight they produce at* London?

```
               C.  qr.  lb.
               195—1—16
                 4
               ----
               781
                25
              -----
              3911
             1563
            ------
     112)    18541
     ----
     165     734
             621        C.   lb.
            ----
              61   *fa.* 165:61 *in* London.
```

CHAP. VII.

The Golden Rule, or Rule of Three Direct.

I. THE *Rule of Three* is ſo called becauſe in it there are always *three Numbers* given to find out a *fourth.* It is alſo called *the Golden Rule* for its excellent performances in the Art of Numbers.

II. The

II. The Rule of Three is either *Single* or *Compound.*

III. The *Single* Rule of Three is either *Direct*, or *Inverse.*

IV. *The Single Rule of Three Direct*, is when there are *three Numbers* given to find out a *fourth* in a Direct proportion; That is, when the *fourth* Number ought to bear such proportion to the *third* as the *second* doth to the *first*; Or, as the *first* is in proportion to the *second*, so is the *third* to the *fourth*. This is called a Direct Proportion.

V. *In the Single Rule of Three*, the two first of the given Numbers imply a Supposition, and the third a Demand.

VI. The *three given Numbers* must be ranked in such order, as that the number to which the demand is affixed may possess the *third* place, and that Number in the Supposition, that is of the same name, kind, or quality with that in the *third* place, must possess the *first* place, and the other number in the Supposition must possess the *second* place, and is evermore of the same name, kind, or quality with the Number sought.

Example. If 18 *Yards of Chamblet cost* 72 s. *what will* 596 *Yards cost at that Rate?*

In this Example the Supposition is this, *viz.* If 18 Yards cost 72 shillings. And in

the

the other Number (596) is implyed a Demand, *viz.* What will 596 Yards coſt? Therefore muſt 596 yards be the *third* Number, and that Number in the Suppoſition which is of the ſame kind with 596 muſt be the *firſt* Number, which here is 18, becauſe that ſignifieth Yards as well as the *third* Number; And the other Number in the Suppoſition, which here is 72, is the *ſecond* Number, and is of the ſame kind with the *fourth* Number, or Number ſought; for the Number ſought by the Queſtion is the Price of 596 Yards, and the *ſecond* Number is the price of the *firſt*, *viz.* 72 ſhillings. Now the given Numbers being duly ſtated and ranked according to the foregoing directions will ſtand thus.

yds.	s.	yds.
18 ——	72 ——	596

VIII. *In the Single Rule of Three Direct, if you Multiply the ſecond Number by the third, or (which is all one) the third Number by the ſecond, and divide the Product thereof by the firſt, the Quotient thence ariſing is the fourth Proportional Number ſought, or Anſwer to the Queſtion.* As in the foregoing Example, *viz.* If 18 Yards of Camblet coſt 72 ſhillings, what will 596 Yards coſt at that rate? The

Num-

Numbers given in the Queſtion being ranked according to the Directions given in the ſixth Rule, I multiply the *ſecond* Number (72) by (596) the *third* Number, and the Product is 42912, which being divided by (18) the *firſt* Number, the Quotient is 2384, which is the *fourth* Number, or Anſwer to the Queſtion. See the whole Operation as followeth, *viz.*

	yds.	s.	yds.	
	18 give	72 what	596	
			72	
			1192	
			4172	
		18)	42912	ſhillings.
fa.	2384		69	
	ſhill.		151	
			72	
			0	

VIII. When (according to the foregoing Directions) you have found out the *Anſwer* to the *Queſtion*, you are always to eſteem it of the ſame name that your *ſecond* Number was of, or reduced to. So here in the foregoing Example the Anſwer to the Queſtion is 2384 *ſhillings*, becauſe the *ſecond* Number is 72 *ſhillings*. And if the *ſecond* Number

had been reduced into *Pence* it makes 864, and then the Anſwer would have been 28608 *pence*, as by the following Operation appears.

```
         yds.      s.              yds.
         18 give  72  what will   596
                  12
                 ---
                 864 pence.
                 596
                ----
                5184
               7776
              4320
             -------
        18)  514944 pence.
  ------
   28608     154
              109
               144
              ----
                 0
```

facit 28608 pence, equal to 2384 ſhillings, as before.

Likewiſe if the *ſecond* Number had been reduced into *Farthings*, it would have been 3456, which being multiplied by (596) the *third* Number, the Product is 2059776, which being divided by (18) the *firſt* Number, the Quotient is 114332 *Farthings*, equal to 119 *l.* 04 *s.* as before; which you may prove at your leiſure.

IX. When

IX. When the *second* Number consisteth of divers Denominations, as of *Pounds* and *Shillings*, or of *Pounds*, *Shillings*, and *Pence*, Then you must reduce it to the lowest name mentioned, or lower if you please, and then multiply the *second* by the *third*, and divide the Product by the *first*, &c. as before directed.

Example 2. If 26 Yards of Broadcloth cost 12 l.—02 s.—08 d. *what will* 248 *Yards of the same cost at that rate?*

The given Numbers in the Example being ranked according to the Directions given in the sixth Rule aforegoing will stand thus,

yds.	l.	s.	d.	yds.
26 ———	12—	02—	08 ———	248

Here the *second* number consisteth of divers Denominations, *viz. Pounds*, *Shillings*, and *Pence*, Therefore must it be reduced to the lowest name mentioned, which is *Pence*, and it makes 2912, which being Multiplied by (248) the *third* number, the Product is 722176, which being Divided by (26) the *first* Number, the Quotient is 27776 *Pence*, because the *second* Number was reduced into *Pence*, which is the Answer to the Question, and may be reduced to

to 115*l.*—14*s.*—08*d.* As you may see by the following Operation.

```
yds.        l.   s.   d.        yds.
26 give  12—02—08  what 248
              20
             ----
             242 shillings.
              12
            -----
            2912 pence.
             248
           ------
           23296
          11648
          5824
         -------
   26)   722176
        -------
12)27776  d.202
   -----
2|0)231|4:8  201
   ------
                 197
      s.  d.     156
                 ---
sa.115:14:8       0
```

X. If the *first* and *third* Numbers, or either of them, consist of divers Denominations, then must they be both reduced to the lowest Denomination mentioned in either of them, as if the *first* number be hundred weights only, and the *third* be Hundreds, Quarters, and Pounds, then must they be both reduced into Pounds, because Pounds are mentioned in the *third* number.

Or

Or if the *first* and *third numbers* being of one kind are notwithstanding of different Denominations, then must they be reduced to one Denomination, as if the *first* be Pounds of weight, and the *third* be Hundred weights, then must the *third* Number be reduced to Pounds as is the *first*.

Example 3. *If* 1 C. *weight of Tobacco cost* 4 l.—5 s.—2 d. *what will* 34 C.—3 *qrs.* —18 ℔. *cost at that rate?*

In this Example because the *third* Number has *Pounds* mentioned therein, therefore must the *first* and *third* Numbers be both reduced to *Pounds*, and the *second* number, which is 4 *l*—05 *s.*—02 *d.* must be reduced into *Pence* by the 5th. Rule of Chap. V. and then the *second* number being multiplied by the *third*, the Product is 3996020, which being divided by the *first*, the Quotient is 35678 *Pence*, which is equal to 148 *l.* —13 *s.*—02 *d.* and 84 remaineth, and how that or any other such such like remainder may be ordered, shall be taught by and by. See the following Operation.

```
 lb.          l.  s.  d.          C.   qr.  lb.
 112  cost    4 — 5 — 2 ————————  34 — 3 — 18
             20                    4
             --                  ----
             85                   139
             12                    28
          -------               -------
          1022 pence.             1120
                                  279
                                -------
                                  3910
                                  1022
                                -------
                                  7820
                                 7820
                                39100
                               ---------
                         112)  3996020
      ---------
  12) 35678                      636
      ---------
       297|3:  2 d.              760
      ----------------
Facit  148: 13: 2 84/112         882
                                  980
                                -------
                                   84
```

Example 4. *If* 14 lb. *of Sugar cost* 5 s. 3 d. *what will* 46 C. *weight cost at that rate?*

In this Example the *third* number must be reduced into *Pounds* because the *first* number is *Pounds*, and it makes 5152, and the *second* number must be reduced into *Pence*, making 63, then the *second* number being multiplied by the *third*, the *Product* is 324576, which

which being divided by (14) the *first* number, the *Quotient* is 23184 *Pence* for the Answer; which is equal to 96 *l.* 12 *s.* as by the following Operation appears.

℔. s. d. C.
14 Sugar 5—3————46
12 112
63 92
506
5152
63
15456
30912
14) 324576
12) 23184 44
193|2 25
fa. 96 : 12 *s.* 117
56
0

XI. When you have multiplied the *second* number by the *third*, and divided the *Product* thereof by the *first*. If any thing remain after Division is ended, it is part of an *Unit* in the Quotient, and its value may be found out thus, *viz.*

Multiply the said *Remainder* by the parts of the next inferiour Denomination that are equal

equal to an *Unit* of the *Quotient*, and divide that *Product* by the *first* Number, ſo ſhall the *Quotient* be the value of the ſaid *remainder* in the ſaid parts, and if any thing yet *remain*, multiply it by the *parts* of the next inferiour Denomination, that are equal to an *Unit of* the laſt *Quotient*, and divide the *Product* by the ſaid *firſt* Number, *&c.* Proceed thus till you have brought it as low as you deſire: And if any thing *remain* at laſt of all, it is part of an *Unit* of the leaſt Denomination into which you reduced the ſaid *Remainder*, and muſt be placed according to the Direction given in the fourth Rule of the fifth Chapter.

In the third Example foregoing after the Diviſion is ended, there is a remainder of 84, which ſheweth that the Anſwer to the Queſtion is not exactly 35068 Pence, or 148 *l.*—13 *s.*—02 *d.* as it is there found, but it is ſomething more; therefore to find the value of this Remainder 84, I multiply it by 4, (becauſe 35678 the ſaid Quotient is Pence) and the Product is 336, which I divide by the firſt Number 112, and the Quotient is 3 Farthings, without any other Remainder, and ſo is the true Anſwer to that Queſtion 148 *l.*—13 *s.*—02 *d.* ¾. Mind the Operation of the next Example.

Example

Example 5. If 1 C. weight of Currans cost 2 l. —14 s. *what will* 24 C. —3*qrs.*—16 ℔. *cost at that rate?*

```
℔.          l.   s.          C.  qr.  ℔.
112 ——————— 2 — 14 ————————— 24 — 3 — 16
            20                4
            54               99
                             28
                            798
                            199
                           2788
                             54
                          11152
                          13940
         112)            150552
      shill. 1344        385
facit pence  2            495
      farth. 2             472
                            24
                            12
                           288
                            64
                             4
                           256
                            32
```

In the work of the foregoing Example you may observe that the second number is reduced

reduced no lower than Shillings, making 543 therefore the Quotient is 1344 Shillings, equal to 67 *l.*—04 *s.* and there is a Remainder of 24: Therefore to find out how many Pence is contained therein, I Multiply it by 12, and the Product is 288, which being divided by 112 (because that is the first number) the Quotient is 2 Pence, and there is a Remainder of 64, which I multiply by 4, (to find its value in Farthings,) and the Product is 256, which I divide again by 112, and the Quotient is 2 Farthings, and there is a remainder of 32, which according to the 4th. Rule of Chapter VI. is $\frac{32}{112}$ of a Farthing; and so the Answer to the Question is 67 *l.* — 04 *s.* — 02 *d.* — 2 *qrs.* $\frac{32}{112}$. The like may be observed of any other.

Example 6. *If* 24 *Yards of Camblet cost* 4 l.—16 s. *I demand how many Yards I may buy for* 126 l. *Facit* 630 yds. The terms being ranked as is directed in the sixth Rule of this Chapter will stand thus, *viz.*

l.	*s.*	*yds.*	*l.*
4—	16———	—24———	—126?

Having thus demonstrated the reason of the *Single Rule of Three Direct* in the six foregoing *Examples*, I shall proceed now to propose several *Questions* in the Rule of Three for the Learners Practice, and only set down

their *Facits*, as a further help to them in the working of their *Questions*.

Question 1. If an Ounce of Silver cost 5 *s.*—4 *d.* what will 46 *oz.*—15 *pw.*—12 *gr.* cost? *Facit* 12 *l.*—09 *s.*—5 *d.* $\frac{288}{480}$.

Quest. 2. If 12 yards of Broad-cloth cost 7 *l.*—06 *s.* I demand how much I ought to give for 26 Pieces, each Piece containing 27 yards? *Facit* 427 *l.*—10 *s.*

Quest. 3. If 18 yards of *Cambrick* cost 4 *l.*—13 *s.* I demand the price of 73 Pieces, each Piece containing 34 Ells *Flemish*? The Ell *Flemish* being 3 quarters of a yard? *Facit* 480 *l.*—17 *s.*— 09 *d.*

Quest. 4. If 17 C. 3 qrs. 17 ℔. of *Tobacco* cost 145 *l.*—12 *s.* I demand how much the Ounce stands me in at that rate? *Facit* 1 *d.* $\frac{2864}{32080}$ *per Ounce.*

Quest. 5. If 112 ℔. of Lead cost 15 *s.*—11 *d.* I demand the price of 54 Fother, each being 19 C. $\frac{1}{2}$? *Facit* 838 *l.*—0 *s.*—1 *d.*

Quest. 6. When 7 ℔. of *Tobacco* cost 5 *s.* —09 *d.* $\frac{1}{2}$, what will 30 C. weight cost? *Facit* 139 *l.*

Quest. 7. When the Tun of Wine cost 51 *l.*—14 *s.* what cost the Quart at that rate? *Facit* 12 *d.* $\frac{1}{4}$.

Quest. 8. At a Noble *per* Week how many Months Board may I demand for 30 *l*? *Facit* 22 Months and 2 Weeks.

Quest.

Quest. 9. A *Grocer* bought 30 Frails of Raisins, each Frail weighing 91 ℔. weight, at 18 *s.*—08 *d* *per* C. I demand how much they amount to? *Facit* 22 *l.*—15 *s.*

Quest. 10. What comes the Commission of 642 *l.* — 11 *s.* — 09 *d.* to at 3 ½ *per Cent.* *Facit* 22 *l.* —9 *s.*—9.

Quest. 11. What comes the Insurance of 375 *l.*—9 *s.*—4 *d.* to at 3 Guinea's *per Cent.* the Guinea's at 21 *s.* 9 *d.* ⅝? *Fa.* 12 *l.* 5 *s.* 6 *d.*

Quest. 12. A Corn Factor bought 248 Quarters of Wheat for 511 *l.*—06 *s.*— 08 *d.* for an 100 Quarters of which he gave 33 *s.*— 04 *d.* *per* Qarter, I demand how much he gave *per* Quarter for the Remainder? *facit* 2 *l.*—06 *s.*—06 *d.*

Quest. 13. If a Piece of Cloth cost 21 *l.*—05 *s.* I demand how many Yards were in the same, the Yard being valued at 12 *s.* —06 *d*? *facit* 34 Yards.

Quest. 13. If a Piece of Cloth cost 24 *l.*—05 *s.*—04 *d.* I demand how many Yards were contained in the same, when the Ell *English* is worth 17 *s.*—04? *facit* 35 Yards.

Quest. 15. Bought 124 Pieces of Camblet for the Sum of 987 *l.* 14 *s.* 8 *d* at 4 *s.* 8 *d.* *per* Yard, I demand how many Yards there were in all, and how many Ells *Flemish* there

were in a Piece? *facit* 4233 Yards, and 45 $\frac{1}{3}$ Ells *Flemiſh per* Piece.

Queſt. 16. A Gentleman hath an Eſtate of 1224 *l. per Annum*, and his Expences one day with another amount to 1 *l.*—13 *s.*—4 *d.* I demand how much he layeth up at the Years end to Purchaſe with? *facit* 615 *l.*—13 *s.*—04 *d.*

Queſt. 17. A Gentleman expendeth one day with another 43 *s.*—06 *d.* $\frac{1}{2}$. and at the Years end layeth up 850 *l.* I demand his annual Eſtate? *facit* 1644 *l.*—12 *s.*—08 *d.* $\frac{1}{2}$. *per Annum.*

Queſt. 18. Bought 3 Hogſheads of Nutmegs, qt. *viz.* at 5 *s.* 7 *d.* the Ounce, I demand what the Neat coſt?

	C.	qr.	lb.
Nº. 1	3	2	21
2	4	1	14
3	4	2	18
	12	2	25

4
———
50
28
———
405
102
———
1425
16
———
8550
1425
———
22800 at 5 *s.* 7 *d.* *Fa.* 6365 *l.*

Queſt.

Quest. 19. A Merchant consigns to his Factor in *Spain* 188 Cloths, with Commission for Sale at 23 *l.*—02 *s.*—02 *d. per* Cloth, and to make Returns from thence, the one half in Wines at 28 *l. per Tun,* and the other half in Sugar at 27 *s. per C. weight,* I demand how much of each ought to be returned for the Cloths?

Answer. The whole value of the Cloth is 4344 *l.*—07 *s*—04 *d.* the half whereof is 2172 *l.*—03 *s.*—08 *d.* which will buy 77 $\frac{2884}{6720}$ Tuns of Wine at 28 *l. per Tun,* and the other half will buy 1609 $\frac{8}{324}$ hundred weight of Sugar.

Quest. 20. If 100 *l.* in 12 Months gain 6 *l* Interest, what will be the Interest of 896 *l.* for the same time? *facit* 53 *l.*—15 *s.*—07 *d* $\frac{20}{100}$

Quest. 21. An Usurer putteth out 880 *l.* to Interest, and at the end of 12 Months he receives for Principal and Interest 932 *l.*—16 *s.* I demand at what rate *per Cent. per Annum* he received Interest? *facit 6 per Cent.*

Quest. 22. I demand what Principal in 12 Months will gain 64 *l.*—10 *s.* at the Rate of 6 *per Cent? facit* 1075 *l.*

Quest. 23. An Orphan is indebted to his Guardian 51 *l.* And the Guardian having in his hands 100 *l.* of the Orphan's, it is agreed

between them that the Guardian ſhall keep the ſame in his hands till the ſaid 51 *l.* be paid by the Intereſt thereof at 6 *per Cent. per Annum.* Now I demand how long he ought to keep the ſame at that Rate? *facit* 8 Year and 6 Months.

Gain and Loſs.

Queſt. 24. A Draper buys 2795 ½ Ells *Flem.* of Ghenting, at 22 *d.* ½ the Ell *Engl.* It is required to know at what price the Cloth muſt be ſold out to gain 15 *l.* 10 *s. per Cent.* Firſt find the price it coſt by the Rule of 3, *fac.* 157 *l.* 4 *s.* 11 *d.* Then ſay, *l. s. d.* If 100 *l.* give 15 *l.* 10 *s.* what will 157 4 11 *facit* 181 *l.* 12 *s.* 4 *d.*

Loſs and Gain.

Queſt. 25. If the aforeſaid Cloth were to be ſold ſo as to loſe 15 *l.* 10 *s. per Cent.* Firſt ſubtract 15 *l.* 10 *s.* out of 100 *l. fa.* 84 *l.* 10 *s.* Then ſay, If 100 *l.* fall to 84 *l.* 10 *s.* what ſhall 157 *l.* 4 *s.* 11 *d. fac.* 132 : 17 : 6.

Fellowſhip.

Queſt. 26. Three Merchants Company; *A* his Stock was 175 *l.* 12 *s.* *B's* 214 *l.* 19 *s.* 4 *d.* *C's* 150 *l.* 11 *s.* 9 *d.* they have gained together 209 *l.* 11 *s.* 4 *d.* I demand each man's part of the ſaid Gain? *Firſt add the ſeveral Stocks into one total,* which makes 541 *l.* 3 *s.* 1 *d.* then make three ſeveral Queſtions in the Rule of Three, *viz.* If

	l. s. d.		*l. s. d.*		*l. s. d.*
If	541:3:1	give	209:11:4	what	175:12:0 *A*
	541:3:1		201:11:4		214:19:4 *B*
	541:3:1		209:11:4		150:11:9 *C*
				facit	

Add all the *facits* together, if it make up the Money to be divided, your Sum is true, if you have any remains on the Divisions, add them up into one Total, which divide by the common Divisor, and the Quotient add to the lowest Denomination.

Fellowship with Time.

Quest. 27. Three Merchants Company, *A* his Stock was 109 *l.* 5 *s.* for 3 Months, *B* 450 *l.* 7 *s.* for 4 Months, *C* 147 *l.* 12 *s.* for 6 Months, they have gained 209 *l.* 7 *s.* 2 *d.* I demand each Man's part.

This is worked as the last precedent Question, only each Man's Stock is multiplied by the time, *viz.*

A 109 5	*B* 450:7	*C* 147:12
3 *mo.*	4 *mo.*	6 *mo.*
A 327:15	*B* 1801:8	*C* 885:12

A 327:15
B 1801: 8
C 885:12

		l. s. d.		*l. s.*
3014:15	gain	209—7—2	what will	327:15 *A*
			what will	1801: 8 *B*
			what will	885:12 *C*
				facit

 Add

Add all the *facits* together, if it make the given Sum 209 *l.* 7 *s.* 2 *d.* your work is true, otherwise false.

The Proof of the Single Rule of Three Direct.

To prove a Question in the *Single Rule of Three Direct*, Multiply the fourth number (or Answer to the Question) by the first, and if the Product thereof be equal to the Product of the second and third, then is the operation truly performed, otherwise not; As in the first *Example* of this Chapter, *viz.*

If 18 yards cost 72 shillings, what will 596 yards cost at that rate? The Answer there found is 28608 pence, which is the fourth Number. Now the Product of the first and fourth, *viz.* 28608 by 18 is 514944, which is equal to the Product of the second and third, *viz.* 864 by 596, as you may see by the following Operation, where the second Number, *viz.* 72 shillings is reduced into 864 pence.

yds.	*d.*	*yds.*	*d.*
18	864	596	28608
	596		18
	5184		228864
	7776		28608
	4320		514944
	514944		

And

And here note, that if any thing remain after Division is ended, it must be added to the Product of the first and fourth numbers, and then must that Sum be equal to the Product of the second and third. As in the third *Example* of this Chapter, which is, if 1 C. weight of Tobacco cost 4 *l.*—5 *s.*—2 *d.* what will 34 C. 3 *qrs.* 18 lb. cost?

The 3 given numbers being reduced are 112 *l.* 1022 *d.* and 3910 *l.* and the fourth number or Answer to the Question is there found to be 35678 *d.* and the Remainder is 84, the Product of the second and third is 3996020, and the Product of the first and fourth is 3995936, to which adding the remainder, the Sum is 3996020, equal to the Product of the second and third, which proves the work to be true.

l.	*d.*	*l.*	*d.*
112 ——	1022 ——	3910 ——	—35678
		1022	112
		7820	71356
		7820	35678
		39100	35678
		3996020	3995936
		remains add	84
			3996020

CHAP. VIII.

The Single Rule of Three Inverse.

I. THE single Rule of *Three Inverse*, is when the *fourth* number, or number sought ought to bear such proportion to the *first* as the *second* doth to the *third*.

II. When a Question in the single Rule of Three is stated, consider whether the *fourth* number (or Answer to the Question) ought to be *more* or *less* than the *second* number, which upon a little consideration you may discover. If it ought to be *more* than the *second*, then must the *lesser* extream be the Divisor, and if it ought to be *lesser* than the *second*, then must the *biggest* of the extreams be the Divisor (in this Case the *first* and *third* numbers are called extreams) and if it fall out that the *third* number is the Divisor, that Question is said to be of the *Single Rule of Three Inverse*. As in the following Examples.

Example 1. If 30 Men can build a Wall in 32 days, I demand in how many days 60 Men may do the same?

The given numbers being ranked according to the Sixth Rule of the 7th. Chapter, will stand as followeth.

men *days* *men*

30——32——60

Then I consider whether 60 Men will do it in *more* or *less* days than 32, and find that they will require *less time* than 32 days, (for the *more* the men the *lesser* the time) wherefore 60, which is the biggest extream, must be the Divisor, and the *first* and *third* must be multiplied together, and their Product, which is 960, being divided by the *third* number 60, the Quotient is 16 days, and in so long time will 60 Men finish the said work.

See the following Operation.

men *days* *men* *days*

30——32——60——16

30

6|0) 96|0

fa. 16 *days.*

Example 2. If 100 *l.* in 12 Months gain 10 *l.* for the Interest thereof, I demand what Principal will gain the same Interest in 8 Months? Here it being required what Principal will gain 10 *l.* in 8 Months, therefore must 100 *l.* Principal be the *second number*, according to the Directions in the Sixth Rule of the 7th. Chapter, and the numbers being ranked accordingly, will stand thus:

Mon.	*l.*	*Mon.*
12 ——	100 ——	8 ?

Here I confider that the ſhorter the time the more muſt be the Principal to gain the ſame Intereſt; wherefore the leſſer extream muſt be the Diviſor, which here is (8) the *third* number, therefore the *firſt* and *ſecond*, *viz.* 12 and 100, muſt be multiplied the one by the other, and the Product is 1200, which being divided by (8) the *third* number, the Quotient is 150 *l.* and ſo much will gain 10 *l.* Intereſt in 8 Months at 10 *per Cent. per Annum*: See the following work.

12 —— 100 —— 8
12
8) 1200
fa. 150

Ex. 3. Lent my Friend 120 *l.* for 6 Months, he promiſing to do me the like courteſie another time; and not long after I had occaſion for a Sum of Money for 9 Months, I demand how much he ought to lend me for that time, to retaliate my former kindneſs? *Facit* 80 *l.* the longer the time, the leſſer ought the Sum of Money to be.

Example 4. A Footman performs a Journey in 12 days, when the day is 15 hours long,

long, I demand in how many days he may perform the ſame when the day is 10 hours long? *facit* 18 days. The ſhorter the day, the more days will the Journey require.

Example 5. How many yards of Matting that is half yard wide, is enough to cover a Floor that is 16 Foot wide, and 28 Foot long? *facit* 296 *yards* of Matting.

Example 6. Suppoſe that (according to the Statute) when the Buſhel of Wheat coſt 4 *s.* the Penny-Loaf ought to weigh Nine Ounces, I demand what the price of the Buſhel ought to be, when the Penny-Loaf weigheth 12 Ounces? *facit* 3 *s. per* Buſhel.

Example 7. If when the Tun of Wine coſt 45 *l.* a certain quantity worth 25 *s.* is ſufficient for the Accommodation of 20 Men, I demand how many Men the ſame 25 *s.* worth will ſuffice when the Tun is worth 30 *l*? *facit* 30 Men, for the cheaper the Wine, the more may be bought for the ſame Money.

Example 8. If when the Tun of Wine coſt 45 *l.* a quantity worth 50 *s.* is enough for the Entertainment of 40 Men, I demand the Price of the Tun when 50 *s.* worth is enough for 90 Men? *facit* 20 *l. per* Tun.

Example

Example 9. If 60 Ells at *London* be equal to 100 Ells at *Antwerp*, and each Ell at *London* contains 20 Nails of an *English* Yard, I demand how many ſuch Nails the Ell of *Antwerp* contains? *facit* 12 Nails.

Example 10 If for 5 *l.* 3 *s.* 4 *d.* I can have 10 *C.* weight carried 140 Miles, I demand how many Miles I may have 14 *C.* weight carried for the ſame Money? *facit* 100 miles.

The Proof of the Single Rule of Three Inverſe.

If the Product of the *Fourth* Term multiplied by the *Third* be equal to the Product of the *Second* multiplied by the *Firſt*, then is the work truly performed, otherwiſe not.

Let us prove the firſt Example of this Chapter, *viz.* If 30 Men can build a Wall in 32 days, I demand in how many days 60 Men may do the ſame? The Anſwer is there found to be 16 days, and the four Terms being duly ranked, ſtand as followeth.

men	*days*	*men*	*days*
30———	—32———	—60———	—16
	30		60
	960		960

The fourth Term (16) being multiplied by (60) the third Term, is 960, which is equal to the Product of (32) the ſecond Term, by (30) the firſt.

CHAP.

CHAP. IX.

The Double Rule of Three Direct.

THE *Double Rule of Three* is, when there are *Five Numbers* given to find out a *Sixth* in proportion thereunto.

II. A Queſtion in the *Double Rule of Three* may be reſolved by Two Single Rules of Three, or by *One Rule of Three compoſed of the Five given Numbers.*

III. When a Queſtion in the *Double Rule of Three* may be ſolved by Two ſingle Rules of Three Direct, that Queſtion is ſaid to belong to the Double Rule of Three Direct.

IV. Of the *Five Numbers* given in the *Double Rule of Three,* Three of them always imply a Suppoſition, and the other Two a Demand. As in the following Example.

If 16 Men can reap 96 Acres of Wheat in 36 days, I demand how many Acres 64 Men may reap in 48 days?

Here the Suppoſition is, If, or ſuppoſe 16 Men reap 96 Acres in 36 days; and the Demand is, how many Acres 64 Men may reap in 48 days.

V. When you would ſolve a Queſtion in the *Double Rule of Three,* the given Numbers

bers are to be ſo ranked, that the *Firſt* and *Third* may be of one Denomination, and the *Second* Number muſt be of the ſame Quality, Name, or Denomination with the Number ſought; and *note*, that the *Firſt* and *Second* Numbers muſt be always of the Suppoſition, and the *Third* of the Demand. So likewiſe muſt the *Fourth* Number be of the Suppoſition, and the *Fifth* of the Demand, and both of one Denomination; ſo may each Queſtion be ſolved by Two ſingle Rules of Three, Two different ways. As in the Queſtion foregoing, which being again repeated, is as followeth.

If 16 Men can reap 96 Acres of Wheat in 36 days, How many Acres may 64 Men reap in 48 days? The Numbers being ranked according to the foregoing Directions, will ſtand as followeth.

	men	*acres*	*men*	
	16	96	64	
days	36		48	*days*

Or Thus,

	days	*acres*	*days*	
	36	96	48	
men	16		64	*men*

VI. Whe-

VI. When a Queſtion in the *Double Rule of Three* is to be ſolved at two ſeveral Operations in the Single Rule of Three, the Anſwer to the Firſt Queſtion muſt be the *ſecond* Number in the ſecond Queſtion, and the *fourth* and *fifth* Numbers muſt be the *firſt* and *third* in the ſecond Queſtion.

So in the firſt order of ranking the given Numbers in the foregoing Queſtion, the three firſt Numbers are 16——96——64, wherein is implyed this Queſtion, *viz.* If 16 Men can reap 96 Acres, how much may 64 reap in the ſame time, *viz.* in 36 days? Multiply and Divide according to the Directions given in the *Seventh* Rule of the Seventh Chapter, and you will find the Anſwer to be 384 Acres; ſo that now I have found how many Acres 64 Men may reap in 36 days, but by the Queſtion it is required to know how much they can reap in 48 days.

Therefore I ſay again by the Single Rule of Three, If 36 days will reap 384 Acres, how many may be done in 48 days? Multiply and Divide, and you will find the Anſwer to the Queſtion to be 512 Acres, and ſo many may 64 Men reap in 48 days, if 16 Men can reap 96 Acres in 36 days. See the whole work as followeth.

men		*acres*		*men*
16	——	96	——	64
days 36	——		——	48 *days*

16 —— 96 —— 64			*days*	*acres*	*days*
	96		36 ——	384 ——	48
	384				384
	576				3072
16)	6144				1536
Fa. 384 *acr.*	134			36)	18432
	64		*Fa.* 512 *acr.*		43
	0				72
					0

In the ſecond ſtating of the above work I multiply 384 by 48 to ſave Paper, for if the two Numbers be multiplied together, it is indifferent whether the Multiplicand or Multiplier be placed uppermoſt.

Or if the Five given Numbers of the foregoing Queſtion had been ranked according to the Second Method laid down at the latter end of the *fifth Rule*, the Anſwer would have been the ſame, and the Operation as followeth.

36 *days*

days	*acres*	*days*
36	——— 96 ———	48
men 16	——— ———	64 *men*

36——96——48	16——128——64
96	128
288	512
432	768
36) 4608	16) 8192
fa. 128 *acr.* 100	*fa.* 512 *acr.* 19
288	32
0	0

I doubt not, but that by the Operation beforegoing this Rule is sufficiently illustrated; but for the Learners further Experience herein, I shall propound several other Examples, and only give their Answers, leaving the Operations to the Industrious Learner.

Example 2. I demand the Interest of 75 *l.* for 18 Months after the rate of *6 per Cent. per Annum*?

This Question may be more intelligibly stated thus, *viz.* If 100 *l.* in 12 Months gain 6 *l.* Interest, what will 75 *l.* gain in 18 Months at that rate? *facit 6 l.* 15 *s.*

Examp. 3. If 12 Men can reap 48 Acres of Wheat in 18 days, I demand how many Acres 36 Men may reap in 24 days? *facit* 192 *Acres.*

Examp.

Examp. 4. If 3 Quarters of Malt is ſufficient for a Family of Six Perſons for two Months, how many Quarters is enough for a Family of 18 Perſons for 12 Months? *facit* 54 Quarters.

Examp. 5. If 8 Reapers have 3 *l.* 4 *s.* for 4 days work, I demand how much 24 Men will have for 16 days work? *fac.* 38 *l.* 8 *s.*

Examp. 6. If 336 ℔. of Bread is ſufficient for 56 Men for 12 days, I demand how much will ſerve 460 Men 96 days? *facit* 22080 ℔. of Bread.

Examp. 7. If 40 Buſhels of Oats be enough for 8 Horſes 20 days, I demand how many Buſhels will ſerve 48 Horſes 12 days? *facit* 144 Buſhels.

Examp 8. A Banker took in 250*l.* to pay Intereſt for the ſame, and at the end of 18 Months he paid 272 *l.* 2 *s.* for Principal and Intereſt, I demand at what Rate *per Cent. per Annum* he paid Intereſt?

CHAP. X.

The Double Rule of Three Inverſe.

I. WHEN a Queſtion in the Double Rule of Three being ſolved at two

two Single Rules, as is taught in the foregoing Chapter, hath one of thoſe Single Rules Inverſe, (for they are never both Inverſe) then is that Queſtion ſaid to be of the *Double Rule of Three Inverſe.*

II. A Queſtion in the Double Rule of Three Inverſe may be ſtated two ſeveral ways, as well as a Queſtion in the Double Rule Direct, and ſo the Inverted Proportion may be either in the firſt or ſecond Operation at pleaſure.

Example 1. If a Footman Travel 240 Miles in 8 days, when the day is 10 hours long, I demand in how many days he may Travel 720 Miles, when the day is 15 hours long?

The given Numbers being ranked according to the fifth Rule of the ninth Chapter, will ſtand as followeth:

	miles	*days*	*miles.*	
	240 ——	—— 8 ——	—— 720	
hours	10 ——	—— ——	—— 15	*hours*

Or Thus,

	hours	*days*	*hours*	
	10 ——	—— 8 ——	—— 15	
miles	240 ——	—— ——	—— 720	*miles.*

Here

Here according to the first manner of ranking the given Terms, the inverted Proportion is in the ſecond ſingle Operation.

III. You may alſo work the Double Rule of Three either *Direct* or *Inverſe* at one Operation by the *Compound Rule of five Numbers*, obſerving to rank the ſeveral Terms as is before taught in the 5th. Rule of the ninth Chap.

IV. And if your Queſtion be of the Double Rule of Three Direct, Multiply the three laſt Terms together for Dividend, and the two firſt for Diviſor, as in the following *Examples, Viz.*

If 100 *l.* in 12 Months require 6 *l.* Intereſt, how much Intereſt will 50 *l.* require in 10 Months?

l.	*mo.*	*l.*		*l.*
100 ——	12 ——	6		50
50 ——	10			10 *m.*
			100	500
			12	6
facit 2 *l.* 10 *s.*			12|00)	30|00
				2|10

V. But if your Queſtion be of the Rule of *Three Inverſe*, Multiply the *firſt*, *ſecond*, and *laſt* Numbers together for Dividend, and the *third* and *fourth* for Diviſor, as in the following Example.

Example.

Example. If 50 *l.* in 10 Months require 2 *l.* 10 *s.* Interest; Of what Principal shall the Interest of 6 *l.* make in 12 Months?

	l.	*mo.*	*l.*	*s.*
If	50	10	2	10
		12	6	

```
                          50
                          10
             l.  s.      ----
             2 — 10      500
facit 100 l.     12        6
             -------    -----
             3|0 )      300|0
             -----------------
                  fa. 100—
```

This last being a Question in the Rule of Three Inverse, according to the Directions given in the Fifth Rule of this Chapter, I Multiply the first, second, and last Numbers together for Dividend, which produces 3000. Then I Multiply 2 *l.* 10 *s.* my third Number, by 12, my fourth Number, and say, 12 times 10 *s.* is 120, I put down a (0) and carry 6 *l.* to the place of Pounds, and say, 12 times 2 is 24 and 6 I carried is 30 for my Divisor. Then I Divide, and the Quotient is 100 *l.* being the Principal that 6 *l.* Interest will make in 12 Months, which was to be proved.

But a more particular application shall be made of the Double Rule of Three, when we come to treat of Simple Interest.

CHAP.

CHAP. XI.

PRACTICE, *a Compendious Method used by Merchants and Tradesmen in Casting up their Commodities.*

PRACTICE is an Abbreviation or Contraction of the *Rule of Three Direct*; and is always known by having 1, or an Integer for the first Term in the *Rule of Three:* And is called the Rule of *Practice*, from the General use of it among *Tradesmen*. Or, because Questions of this Nature may be answered by Operations more speedy and practical than by the *Rule of Three:* But before we proceed further, it will be necessary to give the Learner Tables of such *Aliquot* parts in Money and Weight, which being learned by heart, will very much facilitate his readiness in casting up any sort of Merchandizes.

PRACTICE

PRACTICE TABLE.

s.	*d.*	*l.*	*d.*	*s.*	lb.	*C.wt.*
10	0	$\frac{1}{2}$	6	$\frac{1}{2}$	56	$\frac{1}{2}$
6	8	$\frac{1}{3}$	4	$\frac{1}{3}$	84	$\frac{3}{4}$
5	0	$\frac{1}{4}$	3	$\frac{1}{4}$	28	$\frac{1}{4}$
4	0	$\frac{1}{5}$	$1\frac{1}{2}$	$\frac{1}{8}$	14	$\frac{1}{8}$
3	4	$\frac{1}{6}$	1	$\frac{1}{12}$	16	$\frac{1}{7}$
2	6	$\frac{1}{8}$			8	$\frac{1}{14}$
2	0	$\frac{1}{10}$			7	$\frac{1}{16}$
1	8	$\frac{1}{12}$				

I. *When the given price is Pence, take your parts in Shillings, the Product Divide by 20, gives the Answer in Pounds.*

Example 1.

d.		
1	$\frac{1}{12}$	254 lb. of *Tobac.* at
		2|1 : 2 *d.*
		1 : 1 : 2 *facit.*

d.		
2	$\frac{1}{6}$	254 lb. at 2 *d.*
		4|2 : 4 *d.*
		2 : 2 : 4 *facit.*

d.		
3	$\frac{1}{4}$	716 lb. at 3 *d.*
		27|9
		8 : 19 : 0 *facit.*

d.		
4	$\frac{1}{3}$	215 *yards* at 4 *d.*
		7|1 : 8 *d.*
		3 : 11 : 8 *facit.*

d.		
6	$\frac{1}{2}$	643 *Ounces* at 6 *d.*
		32|1 : 6
		16 : 1 : 6 *facit.*

Here you see that 254 lb. of *Tobacco* at 1 *d.* a pound, divided by the $\frac{1}{12}$ gives 21 *s.* 2 *d.* and

and that divided by 20 (by cutting off the last figures, and taking ½ of it) gives 1 *l.* 1 *s.* 2 *d.* the price of 254 ℔. of *Tobacco*: and for 2 *d.* a ℔. take the ⅙: because 2 *d.* is the ⅙ part of a shilling, and for 3 *d.* a ℔. take ¼: and so for the others at 4 *d.* and 6 *d.*

II. *When the given price are such pence as are no even part of a shilling, take first the greatest even part of a shilling, and then part of that part; add them together, and divide the Product by 20, or cut off the last figure, and take ½.*

d.		2121 *Ells* at 5 *d.*
4	⅓	707
1		176 : 9 *d.*
5		88|3 : 9
		44 : 3 : 9 *facit.*

		794 ℔. at 7 *d.*
6	½	392
1	⅙	65 : 4 *d.*
7		45|7 : 4
		12 : 17 : 4 *facit.*

254 ℔. of *Tobacco* at 9 *d.* and 10 *d.* a ℔.

d.		
6	½	127
3	½	63 6
9	¼	19|0 6
		9 : 10 : 6 *fa.*

d.		254 at 10 *d.* ¾.
6	½	127 shil. in 254 six pen.
4	⅓	84—8 in 254 groats.
½	⅛	10—7 in 254 half pen.
¼	½	5—3 ½ in 254 farth.
		22|7 : 6 ½
		11|7 : 6 ½ *fa.*

Demonstration. In 254 ℔. of *Tobacco* at 10 *d.* ¾ a ℔. there must be 254 *sixpences*, which

is 127 shil. and 254 *groats*, which is 84 *s*. 8 *d*. and 254 *half pence*, which is 10 *s*. 7 *d*. and 254 *farth.* which is 5 *s*. 3 *d*. ½, all these added together, make 227 *s*. 6 *d*. ½, which divided by 20, gives the *facit*, 11 *l*. 7 *s*. 6 *d*. ½.

		614 ℔. at 11 *d*.
6	½	307
4	⅓	204 : 8 *d*.
1	¼	51 : 2
11		56|2 : 10
		28:2 : 10 *facit*.

		563 ℔. at 11 *d*. ½
6	½	281 : 6 *d*.
4	⅓	187 : 8
1 ½	¼	70 : 4 ½
		53|9 : 6 ½
		26:19: 6 ½ *facit*.

III. *If the given price be any number of pence above* 1 s. *and less than* 2 s. *take the* Aliquot *parts in pence*, (as in the last precedent) *to which add the given quantity for the* 1 s. *and proceed as before.*

	Ex. 254 ℔. at 15 *d*.
¼	63 : 6
	31|7 : 6
	15:17:6 *facit*.

	254 at 17 *d*.
⅓	84 : 8
¼	21 : 2
	35|9 : 10
	17:19: 10 *fa*.

	264 *yds*. at 18 *d*.
½	132
	39|6
	19:16 : 0 *facit*.

	295 *gall*. at 19 *d*.
½	147 : 6
⅙	24 : 7
	46|7 : 1
	23:7: 1 *facit*.

	672 lb. at 22 *d.* $\frac{3}{4}$.
$\frac{1}{2}$	336
$\frac{1}{3}$	224
$\frac{1}{8}$	42
	127|4
	63:14 : 0 *facit.*

	456 *Ells* at 23 *d.* $\frac{3}{4}$.
$\frac{1}{2}$	228
$\frac{1}{3}$	155 : 4
$\frac{1}{4}$	38 : 10
$\frac{1}{4}$	9 : 8 $\frac{1}{2}$
	88|7 : 10 $\frac{1}{2}$
	44:7: 10 $\frac{1}{2}$ *fa.*

In 672 lb. at 22 *d.* $\frac{3}{4}$ a lb. I take $\frac{1}{2}$ for 6 *d.* the $\frac{1}{3}$ for 4 *d.* and the $\frac{1}{8}$ for the $\frac{3}{4}$, because $\frac{3}{4}$ is the $\frac{1}{8}$ of 6 *d.* by which you will find that in 672 *six pences* there is 336 shill. and in 672 *groats* there is 224 shil. and in 672 *three farthings* there is 42 shil.

IV. *If the given price be such shillings as are an even part of a pound* Sterling, *take such a part of the given quantity, and the Quotient is pounds.*

	Ells *s.* *d.*
	434 at 1—8
$\frac{1}{12}$	36 : 3 : 4 *facit.*
	674 at 2 *s.* 6 *d.*
$\frac{1}{8}$	84 : 5 : 0 *facit.*
	Crowns
	457 at 5 *s.*
$\frac{1}{4}$	114 : 5 : 0 *facit.*
	295 at 6 *s.* 8 *d.*
$\frac{1}{3}$	98 ; 6 : 8 *facit.*

	yrds.
	271 at 2 *s.*
$\frac{1}{10}$	27 : 2 : 0 *facit.*
	495 at 3 *s.* 4 *d.*
$\frac{1}{6}$	82 : 10 : 0 *facit.*
	Dollars
	612 at 4 *s.*
$\frac{1}{5}$	122 : 8 : 0 *facit.*
	372 at 10 *s.*
$\frac{1}{2}$	186 ; 0 ; 0 *facit.*

In

In this first Example of 434 *Ells* at 1 *s.* 8 *d.* I take the $\frac{1}{12}$ because 1 *s.* 8 *d.* is the $\frac{1}{12}$ of a *l.* and say, 12 in 43 is 3 times, rest 7, which makes the 4 to be 74; then 12 in 74, is 6 times, rest 2, which is 2 *l.* that I turn into Shillings, and say, 12 in 40 *s.* is 3 times, and there rests 4 *s.* which I turn into Pence, and it makes 48 Pence; then 12 in 49 is 4 times. And the *facit* is 36 *l.* 3 *s.* 4 *d.*

V. *If the given price be such shillings and pence as are no even parts of a pound, Multiply the given Quantity by the number of Shillings, and take the* Aliquot *parts of Pence, and proceed according to the Second Rule of this Chapter.*

Ells	
	375 at 8 *s.* 6 *d.*
	8
	3000
$\frac{1}{2}$	187 : 6
	318|7 : 6
	159:7 : 6 *facit.*

Ells	
	493 at 15 *s.* 10 *d.*
	15
	2465
	493
$\frac{1}{2}$	246 : 6 *d.*
$\frac{1}{3}$	164 : 4
	780|5 : 10
	390:5 : 10 *facit.*

	C.	s. d.			C.	s. d.
	295 at	12—9			214 at	7—11
	12				7	
1/2	3540				1498	
1/2	147 : 6			1/2	107	
	73 : 9			1/2	53 : 6	
	376|1 : 3			1/3	35 : 8	
	188:1 : 3 *facit.*				169|4 : 2	
					84:14:2 *facit.*	

VI. *If your given price be any number of Pounds, Shillings, and Pence, Reduce first your Pounds and Shillings into Shillings, and proceed according to the last Rule.*

	Pieces	*l. s. d.*			*Tun*	*l. s. d.*
	754 at	4-13-7			176 at	3-17-10
	83	20			67	20
	2262	83			1232	67
	6032				1056	
1/2	372				11792	
1/6	62			1/2	88	
	6301|6			1/3	58 : 8	
	3150:16:0 *facit.*				1193|8 : 8	
					596:18:8 *facit.*	

VII. *If your given price be any number of pounds, and exceeding five pound, then Multiply your given quantity by the number of the Pounds, and take your* Aliquot *parts in shillings and pence,* viz.

		C.	l. s. d.
		74 at	11-12-6
		11	
s.		814	
10	$\frac{1}{2}$	37	d.
2 $\frac{1}{2}$	$\frac{1}{4}$	9 : 5 : 0	
	l.	860 : 5 : 0 *facit.*	

	hhead.	l. s. d.
	394 at	16--16--4
	16	
	2364	
	394	
$\frac{1}{2}$	197	
$\frac{1}{2}$	98 : 10	
$\frac{1}{4}$	24 : 12 : ~~6~~	
$\frac{1}{3}$	8 : 4 : 2	
	6632 : 6 : 8 *fa.*	

VIII. *If the given Quantity be any number of* C. qrs. *or* lb. *or* Tun. qrs. *and* lb. &c. *work as before where no part is, and take your* Aliquot *parts in Quarters and Pounds, or in* C. qrs. *and* lb. *and add it to your first work.* An Example or two will make this plain.

	C.	s. d.
	75 $\frac{1}{2}$ at	22—6
	22	11—3
	150	
	150	
$\frac{1}{2}$	37 : 6	
	11 : 3	
	169|8 : 9	
	84 : 18 : 9 *facit.*	

	C.	s. d.
	63 $\frac{3}{4}$ at	12 : 10
	12	6 : 5
	756	3 : 2 $\frac{1}{2}$
$\frac{1}{2}$	31 : 6	9 : 7 $\frac{1}{2}$
$\frac{1}{3}$	21 : 0	
	9 : 7 $\frac{1}{2}$	
	81|8 : 1 $\frac{1}{2}$	
	40 : 18 : 1 $\frac{1}{2}$ *facit.*	

In the Example of 63 C. $\frac{3}{4}$ at 12 *s.* 10 *d.* the *C. weight*, I Multiply the *C.* by 12 *s.* and take the parts in pence for the odd pence

then for the $\frac{3}{4}$ of a *C.* I first take the $\frac{1}{2}$ of the price of a *C.* and that makes 6 *s.* 5 *d.* the price of $\frac{1}{2}$ a *C*, and then I take the $\frac{1}{2}$ of that, which gives 3 *s.* 2 *d.* $\frac{1}{2}$, the price of a qr. of a *C.* Add them together, it gives the price of $\frac{3}{4}$ of a *C.* which is 9 *s.* 7 *d.* $\frac{1}{2}$, and must be added to your first work. Two or three Examples more will make it familiar and easie to any Capacity.

	84 *C.* 3 *qrs.* 11 lb. at ——				21 *s.* 10 *d.*
	21			$\frac{1}{2}$	10 : 11
	84		lb.	$\frac{1}{2}$	5 : 5 $\frac{1}{2}$
	168		7	$\frac{1}{4}$	1 : 4 $\frac{1}{4}$
$\frac{1}{2}$	42		4	$\frac{1}{7}$	0 : 9 $\frac{1}{4}$
$\frac{1}{3}$	28				18 : 6
	18 : 6				the price of
	185|2 : 6				3 *qrs.* 11 lb.
	92:12 : 6 *facit.*				

Tun.	*C.*	*qr.*	lb.		*l.*	*s.*	*d.*	
12—	14—	3—	14	at	15—	17—	06	*a Tun.*
							12	
					190—	10—	00	
				$\frac{1}{2}$	7—	18—	9	
				$\frac{1}{5}$	3—	3—	6	
				$\frac{1}{8}$	0—	7—	11 $\frac{1}{4}$	
				$\frac{1}{2}$	0—	3—	11 $\frac{1}{2}$	
				$\frac{1}{2}$	0—	1—	11 $\frac{3}{4}$	
				Facit	202—	06—	1 $\frac{1}{2}$	

CHAP

CHAP. XII.

The Order of Deducting TARE and TRET.

GRoss is the weight of a Commodity, with its *Hogsheads*, *Chests*, *Box*, or whatever else contains it.

Tare is the allowance given for the weight of the Cask, Hogshead, *&c.*

Tret is an allowance of 4 ℔. in 104 ℔. for waste and dust on some sort of Goods.

C. qr. ℔. ℔. ℔.
Ex. 11 *hhds.* qt. 45-3-15 *Gros. Tare* 14 *per* 112
14—$\frac{1}{8}$ ———— *how many* ℔ *Neat?*
5-2-26 *Tare.*
fa. 40-2-17 *Neat.*

I. Here 14 ℔. *Tare* being $\frac{1}{8}$ of 112 ℔. take $\frac{1}{8}$ of the *Gross*, the Quotient gives the whole *Tare*, which subtract from the *Gross*, gives the *Neat* weight.

The Operation is performed thus, Divide the *Gr.* by 8, say, 8 in 45, 5 times, and 5 *C.* remains, which is 20 *qrs.* and 3 is 23; then 8 in 23, 2 times, 7 *qrs.* remains, which turned into pounds by 28, and added to the 15 ℔, makes 211 ℔; then 8 in 211 is 26 times. So the *Tare* is 5 C. 2 *qr.* 26 ℔.

	C.	qr.	℔.		s.	d.
Examp.	49 —	0 —	17	*Neat* at	22 —	6

```
         22           ℔.
         98           14 1/8     2—9—3/4
         98            2 1/7     0—4—3/4
6 1/2    24—6          1 1/2     0—2—1/4
                              fa. 3—4—3/4
      3—4—1/4                 price of 17 ℔.
 110|5--10—3/4
  55|5—4—3/4 facit.
```

If the *Tare* be 16 ℔ in 112 ℔, take $\frac{1}{7}$ of the *Gross*, and work as before.

If 18 ℔ *per* 112 ℔. for *Tare*, take the *Aliquot* parts, *Viz.*

for 16 ℔ take the $\frac{1}{7}$ } Add the *Tare* of 16
for 2 take the $\frac{1}{8}$ } and the *Tare* of 2 together, the total subtract from the Gr. and work as before.

℔. ℔. ℔.
If 20 in 112 for *Tare* { for 16 take $\frac{1}{7}$ ℔.
{ for 4 take $\frac{1}{4}$ of 16

II. When an allowance is made for *Tret*, then (after the *Tare* is subtracted from the *Gross*) the remainder is called *subtle*, which Divide by 26, because 4 ℔ is the 26th. part of 104 (the allowance always given for *Tret*) the Quotient gives the *Tret*, which subtracted from the *subtle*, gives the *Neat* weight.

Ex.

	C. qr. ℔.	℔. ℔. ℔. ℔.
Ex.	45-3-15 Gr. *Tare* 16 in 112 *Tret* 4 in 104	
$16\frac{1}{7}$	6-2- 6 *Tare*	
	39-1- 9 *Subtle.*	4)104
	4	26
	157	
	28	
	1265	26) 4405
	314	169 180
	4405 *pound subtle.*	245
	169 *Tret.*	11
	4226 *Neat pound*— at 6 *d.*	
$6\frac{1}{2}$	211|8 *d.*	
	105:18-0 *facit.*	

III. If the allowance for *Tare* be 8 ℔, 10 ℔, 12 ℔. in 112, or any other lesser number, whether an *Aliquot* part of 112 or not, in such cases, *divide the Gross into two parts* by 2, which will make it half hundreds, then say, 8 is $\frac{1}{7}$ of $\frac{1}{2}$ C. or if 12 ℔. in 112 ℔.

$\left\{\begin{matrix} 8\ \frac{1}{7} \\ 4\ \frac{1}{2} \end{matrix}\right\}$ When you have found your *Tare*, subtract it always out of the whole *Gross.*

I might enumerate Examples, but these being sufficient to instruct any ordinary Capacity in *Tare* and *Tret.*

I shall proceed to shew some other *abbreviated ways* of casting up Goods and Merchandize.

CHAP.

CHAP. XIII.

For Retailers *of* Small Parcels, *as Mercers, Linnen and Wollen Drapers, Haberdashers of Hats,* &c.

THE *most Abbreviated and ready way is to multiply the Price by the Quantity.*

		s.	*d.*
Ex. Sold 7 *yrds* of Cloth at		14—	6 a *yrd.*
			7
fa.	*l.* 5—	1—	6

Say, 7 times 6 is 42, which is 3 *s.* 6 *d.* set down 6 *d.* and carry 3 *s.* to the place of *shill.* and say, 7 times 4 is 28, and 3 I carry is 31, set down 1 *s.* and carry 3 Angels to the place of *tens* of *shill.* and say, 7 times 1 is 7, and 3 I carry is 10 Angels, which is 5 *l.* set a (0) in the place of *shill.* and fix the 5 *l.* in the place of *pounds*, so the price of 7 *yards* is 5 *l.* 1 *s.* 6 *d.*

		s.	*d.*	
Ex. 2. Sold 11 ½ *yards* at		13—	3	for half a yard take ½ of 13 *s.* 3 *d.* and add to the product of 11.
			11	
	7—	05—	09	
		6—	07 ½	
Facit l.	7—	12—	04 ½	

Ex. 3.

		l.	*s.*	*d.*
Examp. 3. Sold 14 $\frac{5}{8}$ *yards* at		1	07	10
				7
		9	14	10
				2
		19	09	08
$\frac{4}{8}$	$\frac{1}{2}$	00	13	11
$\frac{1}{8}$	$\frac{1}{4}$	00	03	05 $\frac{3}{4}$
Facit l.		20	07	00 $\frac{3}{4}$

Find first the price of 7 *yards, fa.* 9 *l.* 14 *s.* 10 *d.* which multiplied by 2, gives 19 *l.* 9 *s.* 8 *d.* the price of 14 *yards,* then take the *Aliquot* parts of $\frac{5}{8}$ for the price of one *yard,* as you see in the Operation: The *facit* is 20 *l.* 7 *s.* 0 *d.* $\frac{3}{4}$.

	l.	*s.*	*d.*
Ex. 4. Sold 7 C. $\frac{1}{2}$ of Currans at	2	13	6
			7
	18	14	6
	1	6	9
facit	20	01	3

Obj. There are many Numbers under 100 that are not included in the Mult^{n}. Table, or being *multiplied together,* will not produce the given quantity; and so consequently cannot be done by this *new way of Practice.*

Answ. It's very true, there are several numbers under 100, that no two numbers multiplied

multiplied together can produce them, ſuch as 13, 17, 19, 26, 29, 31, 34, 37, and many more.

Rule. In ſuch caſes *Multiply by two ſuch numbers as being multiplyed together will come neareſt to ſuch odd numbers, then multiply the price by that part which wants to make up the given quantity.* An Example of which follows.

	s. d.
5 *Ex.* 29 *Ells* at	7—9
	7
	2—14—3
	4
	10—17—0
	7—9
fa.	11—04—9

Here I Mult. by 7 and 4, becauſe 7 times 4 is 28, and for the odd *Ell* to make it 29, I add the price of the Ell to the Product, *fa.* 11 *l.* 4 *s.* 9 *d.*

6. *Example.* If 34 Ells at the ſame price, Mult. by 8 and 4, makes 32, and multiply the price of 1 Ell by 2, and add that to the Product, makes 34.

C. qr. ℔.		l. s. d.
7 *Ex.* 15—3—7	at	4—15—06
		5
		23—17—06
		3
		71—12—06
		2—07—09
		1—03—10 ½
		5—11 ½
	l.	75—10—01 *Facit.*

Goods

Goods Sold by 112 ℔ the C. wt. } 1. Account 2 *s.* 4 *d.* for every farthing in the price of 1 pound weight.

d. ℔.

Ex. 1. At 3 ½ the pound, what 112

14 32—8 *d.*

2. Or Multiply the pence, that 1 pound *wt* cost by 7, and divide by 15, the Quotient is the price in pounds of a hundred weight.

Ex. At 5 *d.* the pound, what cost 132

7

15)35

s. d.

fa. l. 2-6-8

Say, 15 in 32, 2 times, rest 5, which is 100 *shill.* then 15 in 100, 6 times, rest 10, it makes 120 *d.* then 15 in 120 is 8 times, *facit* 2 *l.* 6 *s.* 8 *d.*

3. Multiply the pounds in mony that 112 cost by 15, and divide the Product by 7, the Quotient gives the price 1 pound cost.

℔. *l. s. d.* ℔.

If 112 cost 2—06—8 what cost —— 1

5

11—13—4

3

7) 35—00—0

fa. 5 pence

Goods sold by 100 } 4. Mult. the pence that 1 ℔. cost by 5, and divide by 12, the product is the price in pounds.

At

At 15 *d.* the Ounce what cost 100 Ounces?

    5
12) 75
facit 6 : 5 *s.*

5. Mult. the pounds in Money 100 ℔ wt. cost by 12, and divide by 5, the Quotient gives in pence the price of 1 pound.

l. *s.*
If 100 cost 6—5 what cost 1?

      12
5) 75 : 00   *d.*
   15 :   *fa.* 15

Things sold by 120, *such as Deals,* &c.

6. Multiply the pence that 1 cost by 2, and divide by 4, the Quotient is the price of 120.

d.
What cost 120 *Deals*, at 13 the Deal-board?

      2
4) 26   *s.*
fac. 6—10

7. Or divide the pence that 1 is worth by 2, the Quotient will be pounds.

What cost 120 yards of Ribbon at 5 *d.*

facit 2—10 *s.*

Wine

8. *For Things sold by* 200, prefix only a Cypher.

What cost a Bale of Paper, quantity 200 Reams, at 6 *s.* a Ream? *Facit* 60 *l.*

Wine or Oyl sold by the Tun of 252 *Gallons.*

9. So many pound the Tun cost, abate so many shillings, and the Gallon will be worth so many pence.

Ex. If 252 gall. cost 25 *l.* what cost 1 gall.

1—5

s. *d.*

23—15 *fac.* 1—11

Here 20 *s.* is valued at 1 peny, so that 23 *l.* 15 *s.* is but 1 *s.* 11 *d.* $\frac{3}{4}$, the price of 1 Gallon of Oyl.

10. *For Things sold by* 300, Prefix a Cypher to the price of one, take half, and add them together.

What cost 300 Chaldron of Coals, at 25 *s.*

250
125
375 pound.

11. *For things sold by* 500, Put a Cypher to the price, then double it, take half, and add the two last together.

What

What coſt 500 Quarters of Corn, at 31 *s.* a Quarter?

$$\begin{array}{r} 310\ s. \\ 2 \\ \hline 620 \\ 155 \\ \hline \end{array}$$

facit 775 pound.

12. *For Things ſold by* 600, Put a Cypher and treble it.

What coſt 600 Hats at 9 *s.*

$$\begin{array}{r} 90 \\ 3 \\ \hline \end{array}$$

facit 270 pound.

13. *For Things ſold by* 700, Put a Cypher, treble it, take half, and add the two laſt together.

What coſt 700 Gallons at 11 *s.*

$$\begin{array}{r} 110 \\ 3 \\ \hline 330 \\ 55 \\ \hline \end{array}$$

facit 385 pound.

There are abundance of other *ſhort ways*, which cannot well be compriſed in this little Tract: Theſe already given are ſufficient for any ingenious inventive Head to lay a good Foundation, from whence he may raiſe what Structure he pleaſe.

CHAP.

CHAP. XIV.

INTEREST is either *Simple* or *Compound*.

Simple Intereſt is that which ariſeth or is computed from the Principal only. And here all Queſtions are done by the Double Rule of Three (called the Compound Rule of five Numbers) or Practice.

Ex. What will the Intereſt of 275 *l.* 11 *s.* 3 *d.* come to for a Year, at 6 *l. per Cent?*

State your Queſtion by the Rule of Three, and ſay,

	l.		*l.* *s.* *d.*
If 100 gain 6, what will			275—11—3
			6
		l.	16|53—07—6
l. *s.* *d.*		*s.*	10|67—20
fa. 16·10·8 $\frac{10}{100}$			——12
		d.	8|10

Here 275 *l.* 11 *s.* 3 *d.* Principal is multiplied by 6 *l.* (the Intereſt) being the middle number, and divided by 100 the firſt number by cutting off 2 Figures in the Dividend, reſt 53 *l.* which multiplied by 20, gives 1067 ſhillings, which divided again by 100 as before, reſt 67 *s.* which multiplied by 12, and

and divided as before, gives *fac.* 16 *l.* 10 *s.* 8 *d.* the Intereſt for 1 Year.

l. *s.* *d.*
275—11—3 for a Year at 5 *l. per Cent.*
5
13|77—16—3
20
15|56
12
6|75
fa. 13—15—6 $\frac{75}{100}$

l. *s.* *d.*
275—11—3 at 5 $\frac{1}{2}$ *per Cent.*
5
1377—16—3
$\frac{1}{2}$ 137—15—7 $\frac{1}{2}$
15|15—11—10 $\frac{1}{2}$
20
3|11
12
1|42
4 *l.* *s.* *d.*
1|70 *fac.* 15—3 . 1 $\frac{1}{4}$ $\frac{70}{100}$

What

What comes the Insurance of 975 *l.* 13 *s.* 4 *d.* to, at 4 Guyneaes *per Cent.*

	l.	*s.*	*d.*
	975 —	13 —	4
			4 —— 6 *s.*
	3902 —	13 —	4
$5\frac{1}{4}$ ——	243 —	18 —	4
$1\frac{1}{5}$ ——	48 —	15 —	8
	41|95 —	07 —	4

—— 20 *fac.* 41 — 19 — $0\frac{3}{4}$ $\frac{52}{100}$ (*l. s. d.*)

19\|07

—— 12

00\|88

—— 4

3\|52

l.	*s.*	*d.*
275 —	11 —	3 at 5 *per Cent.* for 14 months.

	l.	*s.*	*d.*
The Int. of 1 year is	13 —	15 —	06
2 Months $\frac{1}{6}$ ——	2 —	5 —	11
facit	16 —	01 —	05 Int. for 14 *m.*

275—11—3 at 5 *per Cent.* for 3 year 5 *m.* 20 *days*?

The Intereſt of a year is—— which multiplied by the 3 years, and take *Aliquot* parts for 5 *months* and 20 *days*, as you ſee in the Operation.

		l.	s.	d.
		13	15	06
				3
m.		41	6	6
	$4\frac{1}{3}$	4	11	10
	$1\frac{1}{4}$	1	2	$11\frac{1}{2}$
days	$10\frac{1}{3}$	0	7	$7\frac{3}{4}$
	$10\frac{1}{3}$	0	7	$7\frac{3}{4}$
fac.		47	16	7

The way uſed by *Bankers* for caſting up *Intereſt* is generally by days, *thus*,

They bring the Principal Money into Pence, and Multiply it by the days it is out at Intereſt, and divide by 6083 for 6 *per Cent.* And 7300 for 5 *per Cent.* (which are the days of a year multiplied by 100, and divided by the rate of Intereſt.) An Operation in the Compound Rule of five Numbers, *viz.*

If 100*l.* in 365 days gain 6 *l.* Intereſt, what will 75 *l.* gain in 94 days?

Exam.

l. *s.* *d.*

Exam. 275—11—3 at Intereſt 70 days (at 6 *per Cent.*

```
        20
      ----
      5511    12) 761 pence  (6) 36500
        12        6|3—5            6083
      ----
     66135    fac. 3--3--5
        70
     -------
6083) 4629450
761    37135
        6370
       -----
         287
```

Exam. 100 *l.* at Int. for 75 days at 5 *per C.*

```
      20
     ----          fac. 20 s. 6 d.
    2000
      12                 365
   -----                 100
  240|00               ------
      75               5) 36500
  ------               --------
  120000                  7300
 168000
 --------
 18000|00       73|00|18000 |00
                       340
                12) 246| 480
                ------------
                fa. 20 s. 6 d. 42
```

CHAP.

CHAP. XV.

Compound Interest *is that which ariseth from the* Principal, *and also from the* Interest *thereof, and therefore is called* Interest *upon* Interest.

THIS sort of Interest is counted very unlawful, and is seldom, or never allowed, but by particular Contract or Valuation of Money sometimes of Purchases.

The best way of working *this sort of Interest* is by Decimals.

Ex. 275 *l.* 11 *s.* 3 *d.* forborn 5 years, at 6 *per Cent. per Annum*, Interest upon Interest, what will the same amount to?

Reduce the 11 *s.* 3 *d.* into a Decimal Fraction, according to the Third Rule of the Seventeenth Chapter of this Book.

11 *s.* 3 *d.* is $\frac{135}{240}$ of a pound *Sterling*.

which brought into a Decimal Fraction, is 5625, the Operation of the Question is, *viz.*

If

l. *l.*	*l.*	
If 100 gain 6, what will	275, 5625	—— 6
	16, 5337	
1 Year ——————	292, 0962	—— 6
	17, 5257	
2 Year ——————	309, 6219	—— 6
	18, 5773	
3 Year ——————	328, 1992	—— 6
	19, 6919	
4 Year ——————	347, 8911	—— 6
	20, 8734	
5 Year ——————	378, 7645	—— 6

Facit 368*l.* 15*s.* 4*d.*

..ere the Third Number is Multiplied by 6, the Second Number, and Divided by 100, the First Number, which is done by setting out the two first figures towards the right hand, and casting them away as you multiply them, to *abbreviate* the work of Multiplications, which would be very large, were they all set down, where 15, or more years Interest is forborn, besides 4 or 5 places of Decimals will be correct too nigh a Farthing, or little more, so that the *facit* makes 365 *l.* 15 *s.* 4 *d.* the Decimal Fraction being valued according to the sixth Rule of the seventeenth Chapter of this Book.

CHAP. XVI.

Rebate *or* Discount *is, when a Sum of Money due at any time to come, is satisfied by the payment of so much* present Money, *as being put forth at a certain* Rate of Interest *for the time being, will be equal to the Sum* first due.

IN *Rebate*, 12 Months is the *first* Number, the Rate of Interest the *second*, and the time proposed, the *third* Number.

 Then

Then say, If 100, and that *facit* (added together) *abate* that *facit*, what shall the given Sum *Rebate?*

The Quotient or Quotients shew the *Rebate*, which substracted out of the given Sum, shews the Money to be paid presently.

Exam. What will the Rebate of 795 *l.* 11 *s.* 2 *d.* come to for 11 Months, at 6 *l. per Cent.*

If 12 *mo.* give 6 *l.* what will 11 *mo.*? *facit* 5 *l.* 10 *s.* Then,

If 105 *l.* 10 *s.* Rebate 5 *l.* 10 *s.* what will 795 *l.* 11 *s.* 2 *d.* *facit* 41 *l.* 9 *s.* 5 *d.*

Exam. 2. The Rebate of 795 *l.* 11 *s.* 2 *d.* come to for 17 *mo.* at 6 *per Cent.*

If 12 *mo.* give 6 *l.* what will 17 *mo.* *facit* 8 *l.* 10 *s.*

If 108 *l.* 10 *s.* Rebate 8 *l.* 10 *s.* what 795 *l.* 11 *s.* 2 *d.* *facit* 62 *l.* 6 *s.* 5 *d.*

Exam. 3. Sold Goods for 795 *l.* 11 *s.* 2 *d.* to be paid at 2, 3 Months, (*that is, half at 3 Months, and the other half at 3 months after that*) if all the Money be paid presently, what must be discounted?

First, Divide the given Sum into two parts, according to the time of payment, as you see here; Then say,

	l.	*s.*	*d.*
If 12 *mo.* give 6 *l.* what will 3 *mo.*	795	11	2
facit 1 *l.* 10 *s.* 2)			
	397	15	7

If 101 *l.* 10 *s.* abate 1 *l.* 10 *s.* what will 397 *l.* 15 *s.* 7 *d.* *facit* 5 *l.* 17 *s.* 6 *d.*

If 12 *mo.* give 6 *l.* what will 3 *mo.* give? *facit* 3 *l.*

If 103 *l.* abate 3 *l.* what will 397 *l.* 15 *s.* 7 *d.* *facit* 11 *l.* 11 *s.* 8 *d.*

Add the Sum of the Rebates together, and substract it out of the given Sum, gives the Money to be paid presently.

795

l. *s.* *d.* 795—11—2

379—15—7 for 3 Months——— 5—17—6

397—15—7 for 6 Months———11—11—8

All the Rebate 17—09—2

The Money to be paid presently 778—02—0

Ex. 4. Sold Goods for 795 *l.* 11 *s.* 2 *d.* to be paid at 3, 2 *months*, if all the Money be paid presently, what must be discounted?

Divide the given Sum into three parts, and work as before. *facit*

Ex. 5. Sold Goods for 795 *l.* 11 *s.* 2 *d.* to be paid at 4, 1 *months*, if all the Money be paid down, what must be discounted? *fa.* 9 *l.* 15 *s.* 9 *d.* $\frac{1}{2}$.

Divide your Money into 4 payments, then work as before, *viz.*

12 *mo.*——6 *l.*——1 *mo.*————*fa.* 10 *s.*

100 *l.* 10 *s.* abate 10 *s.* what will 198 *l.* 17 *s.* 9 *d.*

facit 19 *s.* 9 *d.*

12 *mo.*——6 *l.*——2 *mo.*————*facit* 1 *l.*

101 *l.*—1 *l.*—198 *l.* 17 *s.* 9 *d.* *fa.* 1 *l.* 19 *s.* 4 *d.*

12 *mo.*——6 *l.*——3 *mo.*————*facit* 1 *l.* 10 *s.*

101 *l.* 10 *s.* abate 1 *l.* 10 *s.* what 198 *l.* 17 *s.* 9 *d.*

facit 2 *l.* 18 *s.* 9 *d*

12 *mo.*——6 *l.*——4 *mo.*————*facit* 2 *l.*

102 *l.* abate 2 *l.* what will 198 *l.* 17 *s.* 9 *d.*

facit 3 *l.* 17. 11 *d.*

CHAP. XVII.

***Fractions are of two kinds,* Vulgar *and* Decimal.**

A *Vulgar Fraction* is caused by Division of whole Numbers, the Remainder of which being less than the Divisor, called the Numerator, is always the *Dividend*, and the Denominator is the *Divisor.*

$\frac{3}{4}$ Numerator. Denominator.

A Decimal Fraction is ſuch a one, whoſe Denominator is underſtood, and therefore need not be expreſſed: And is an *Unit* with as many Cyphers following it, as there be Figures and Cyphers in the Numerator.

Having told you the Nature, I proceed now to ſhew you the Uſe of *Vulgar* and *Decimal Fractions* together under the ſame head, and that with all plainneſs, and yet with as much brevity as the Nature of the thing will bear.

In Decimals the value of every *figure* or *Cypher decreaſes* by a ten-fold proportion from the Unites place towards the right hand, as the *whole numbers* do towards the left hand, as in the Table, *Viz.*

Of a Unite, or 1.

6 *C Thou.*	5 *X Thou.*	4 *Thou.*	3 *C.*	2 *X.*	1 *Unite.*	3 *Tenths.*	3 *Hund.*	4 *Thou.*	5 *X Thou.*	6 *C Thou.*
Whole Numbers,						Decimals.				

Cyphers annexed to a Decimal Fraction, alters not his value.

	Decimals		Vulgar Fract.
as thus	,50 ,500 ,5000	expreſſed in	$\frac{5}{100}$ $\frac{5}{1000}$ $\frac{5}{10000}$

Each Decimal being equal to $\frac{5}{10}$ of any Integer, as you ſee expreſſed by the Vulgar Fractions.

Cyphers prefixed to a Decimal Fraction, decreaſeth its Value by a ten-fold proportion.

	Decimals		Vulgar Fract.
as thus	,05 ,005 ,0005	expreſſed by	$\frac{5}{100}$ $\frac{5}{1000}$ $\frac{5}{10000}$

Next

Next to Abbreviation and Valuation of *Vulgar Fractions*, there is little required, but to *know* how to bring a Fraction of a *lesser* name into the Fraction of a *greater* name: And to *Reduce* Fractions of divers *unequal Denominators* to one common *Denominator*, which being well underftood, you may with as much eafe *Add*, *Subftract*, *Multiply*, and *Divide* a *Fraction* as you can a whole Number.

In *Decimals* a Fraction is feldom abbreviated, therefore,

1. *To abbreviate any Vulgar Fraction*, find fuch a Number for dividing both the Numerator and Denominator thereof, fo that no Remainder be on either of the Divifions.

Ex. Abbr. $\frac{96}{120}$ into $\frac{8}{10}|\frac{4}{5}$ its loweft term.

Say, 12 in 98, 8 times, and 12 in 120, 10 times, then the Fraction is $\frac{8}{10}$, then fay, 2 in 8, 4 times, and 2 in 10, 5 times, then the Fraction is $\frac{4}{5}$, fo that 4 is to 5, as 96 to 120.

2. *To know what part of a Pound Sterling any number of fhillings and pence are*, Bring the fhillings and pence into pence for a Numerator, and place 240 under it, (the pence of one pound) for a Denominator.

Examp. What part of a *l.* is 11 *s.* 3 *d.*

$\frac{12}{135}$ *fa.* $\frac{135}{240}$.

3. *To Reduce Vulgar Fractions into Decimals*, *Add* Cyphers at pleafure to the Numerator, and divide by the Denominator. *Exam. Viz.*

Reduce 11 *s.* 3 *d.* into a Decimal Fraction.

12	24|0)	1350000
135		150
240	*fa.* ,5625	60
		120
		0

Ex. Reduce $\frac{4}{5}$ into a Decimal Fraction.

$$\begin{array}{l} 5)\,4000 \\ \hline ,800 \end{array} \qquad fa.\ ,800$$

4. *To value a Vulgar Fraction*, Multiply the Integer into the Numerator, and Divide by the Denominator.

What is the $\frac{5}{8}$ of a pound *Sterling*. 20 *s.*

$$\begin{array}{r} 20\ s. \\ 5 \\ \hline 8|100\ d. \\ \hline fa.\ 12\text{--}6 \end{array}$$

An Ell worth 7—9 (*s.* *d.*) what is $\frac{2}{5}$ worth?

$$\begin{array}{l} \quad 2 \\ \hline 5)\ 15\text{—}6 \\ \hline fa.\ \text{—}3\text{—}1\ \frac{1}{5} \end{array}$$

5. *To value a mixt Number*, Multiply the mixt Number by the Numerator, and Divide by the Denominator. *Ex. Viz.* *l.* *s.* *d.*

A Ship worth 794—11—9, what is $\frac{5}{8}$ worth?

$$\begin{array}{l} \qquad\qquad 5 \\ \hline 8)\ 3972\text{—}18\text{—}9 \\ \hline fa.\ 496\text{—}12\text{—}4\frac{1}{8}. \end{array}$$

6. *To value a Decimal Fraction expressing Coin*, every *Prime* or *Unite* in the first place is 2 *s.* value. Every 5 in the second place is 1 *s.* and the rest farthings, but if they exceed $\frac{25}{48}$, there must be one farthing abated.

Reduce $\frac{7}{9}$ of a pound into a Decimal Fract.

$$\begin{array}{l} 9),700000 \\ \quad ,77777 \end{array}$$

Here 2 *primes* is 14 *s.* and 5 taken out of the *second* place is 1 *s.* which makes 15 *s.* then 2 remains, which is 27 to the *thirds*, or place of farthings, out of which abate 1 for $\frac{25}{48}$, it makes *fac.* 15 *s.* 6 *d.* $\frac{1}{2}$ which is the $\frac{7}{9}$ of a pound *Sterling*.

7. *To*

7. *To Reduce Vulgar Fractions to a Common Denominator*, Multiply the *Numerator* of each Fraction into every *Denominator*, except its own, which makes that Product a *new Numerator*; then Multiply all the Denominators continually together, and that Product is a *Common Denominator* to all the *new Numerators*. *Ex viz.*

Reduce $\frac{2}{3}$ *l.* and $\frac{3}{4}$ *l.* to a Common Denominator.
fa. $\frac{8}{12}$ and $\frac{9}{12}$.

Here 12 is the Common Denominator to both the *New Numerators*, *viz.* 8 and 9, and you find that 8 is to 12, as 2 to 3, and 9 is to 12, as 3 to 4.

So that $\frac{8}{12}$ is = to $\frac{2}{3}$ *l.* and $\frac{9}{12}$ is = to $\frac{3}{4}$ *l.*

Reduce $\frac{3}{4}$, and $\frac{5}{6}$, and $\frac{7}{8}$ of a *l.* to a Com. Den.

4			
6	18	40	42
	8	4	4
24			
8	144	160	168
192	192	192	192

To prove your Work, Divide your new Numerator by the Numerator of that Fraction, and Divide the Common Denominator of the Fraction by the Denominator, if both Quotients are equal, your Work is true.

Example. $\frac{144}{192}|\frac{48}{48}$ here 144 divided by 3, makes 48, and 192 divided by 4, gives 48, which was to be proved. Or, you may prove your Work by *Abbreviation of Fractions*, but that is attended with much difficulty, where 4 or more Fractions are reduced to a Common Denominator.

Now this *Reduction of Fractions* is of little use, otherwise than to prepare a Fraction, to be either *Added*, *Substracted*, *Multiplied*, or *Divided*.

As if the $\frac{3}{4}$ and $\frac{5}{6}$ and $\frac{7}{8}$ *l.* were to be added together, Reduce them first into a Common Denominator, as in *the last Rule*, it makes *fa.* $\frac{144}{192}$ and $\frac{160}{192}$ and $\frac{168}{192}$. Add all the new Numerators together, makes 472, which divide by 192, the Common Denominator, makes *fa.* 2 *l.* $\frac{88}{192}$, as in the following Example.

$$\text{Addit. of Vulgar Fractions.}\left\{\begin{array}{r}144\\160\\168\end{array}\right.$$

$$\begin{array}{rrl} 192) & 472 & \quad l. \quad s. \quad d. \\ \hline 2) & 88 & fa.\ 2\tfrac{88}{192},\ \text{or}\ 9-2 \end{array}$$

And if the $\frac{3}{4}$ and $\frac{5}{6}$ and $\frac{7}{8}$ *l.* were to *be added* together in *Decimals*, Reduce them first into Decimal Fractions, according to the *Third Rule* of this Chapter, and the Operation stands, *viz.*

$$\text{Addition of Decimals}\left\{\begin{array}{ll} & 0000 \\ \hline \frac{3}{4} & ,75 \\ \frac{5}{6} & ,8333 \\ \frac{7}{8} & ,875 \\ \hline & fa.\ 2,4583 \end{array}\right.$$

Say, 4 in 30 is 7 times, and 4 in 20 is 5 times, and so for the rest.

l. *s.* *d.*
or, 2—9—2

By this Addition you see how much less work is made by *Decimals* than is in *Vulgar Fractions*, and how easie their Value is found out according to the *Sixth Rule* of this Chapter.

8. *To Reduce* (*Compound Fractions* or) *Fractions of a lesser Name into the Fractions of a greater*, Multiply the *Numerators* together for a new *Numerator*, and the *Deno-*

Denominators multiply together for *a new Denominator.*

Reduce $\frac{3}{4}$ of a penny into the proper Fraction of a pound *Sterling.*

Say, $\frac{3}{4}$ of $\frac{1}{12}$ of $\frac{1}{20}$, or $\frac{3}{4}$ of $\frac{1}{260}$, *fa.* $\frac{3}{960}$.

9. *To Reduce a mixt Number of a lesser Name into the Fraction of a greater.* Reduce the mixt Number into an improper Fraction, and work as before:

Reduce 3 *d.* $\frac{1}{2}$ into the prop. fr. of a *l. ster.*

$\frac{7}{2}$ of $\frac{1}{12}$ of $\frac{1}{20}$ or $\frac{7}{2}$ of $\frac{1}{240}$, *fa.* $\frac{7}{480}$.

By the same Rule you may *Reduce* any sort of Weight or Measure.

For Compound Fractions, their use is chiefly to bring Fractions of divers denominations to one and the same denomination:

As if the $\frac{3}{4}$ of a penny, $\frac{2}{3}$ of a shilling, and $\frac{7}{8}$ of a pound were added together.

The $\frac{3}{4}$ *d.* must be Reduced into the fraction of a *l.* and the $\frac{2}{3}$ of a shilling must be reduced into the Fraction of a *l.* thus,

$\left.\begin{array}{l}\frac{3}{4} \text{ of } \frac{1}{240} \textit{ fa. } \frac{3}{960} \\ \frac{2}{3} \text{ of } \frac{1}{20} \textit{ fa. } \frac{2}{60}\end{array}\right\}$ then the Fractions to be *added*, are $\frac{3}{960}$, and $\frac{2}{60}$, and $\frac{7}{8}$, which Reduce to a Common Denominator, and add them together, either by Decimals or Vulgar Fractions.

CHAP. XVIII.

ADDITION of *FRACTIONS.*

1. IF *the Fractions to be added have one Common Denominator,* Add all the Numerators together, and divide the Product by the Common Denominator.

Example. Add $\left\{\begin{array}{c}\frac{8}{12}\\ \frac{5}{12}\\ \frac{7}{12}\end{array}\right\}$ of a pound together.

$$\begin{array}{l} \underline{12)20} \\ fa.\ 1\frac{8}{12} \end{array}$$

2. *If the Fractions to be added be of different Denominators,* Reduce them to a Common Denominator, according to the *Seventh Rule* of the last Chapter, and proceed as before.

Ex. Add $\frac{7}{8}$ and $\frac{3}{4}$, and $\frac{2}{3}$ *l.* together.

$$\begin{array}{ccccc} 8 & & & & \\ \underline{4} & 28 & 24 & 8 & 84 \\ 32 & \underline{3} & \underline{3} & \underline{8} & 72 \\ \underline{3} & \underline{84} & \underline{72} & \underline{64} & \underline{64} \\ 96 & 96 & 96 & 96 & \underline{96)220} \\ & & & & fa.\ 2:28 \end{array}$$

To add $\frac{7}{8}$ and $\frac{3}{4}$ and $\frac{2}{3}$ *of a pound in Decimals,* Reduce them into Decimal Fractions, according to the *Third Rule* of the last Chapter, and add them up as in whole Numbers, keeping the place of Units just under each other.

$$\text{Add}\left\{\begin{array}{rl} & \underline{0000} \\ \frac{7}{8} & ,875 \\ \frac{3}{4} & ,75 \\ \frac{2}{3} & \underline{,6666} \\ & 2,2916 \end{array}\right. \quad \begin{array}{l} \quad\ \ l.\ \ s.\ \ d. \\ fa.\ 2-5-10 \end{array} \qquad \begin{array}{r} \underline{8)\ 7000} \\ \underline{,875} \\ \underline{4)\ 3000} \\ 75 \\ \underline{3)\ 20000} \\ 6666 \end{array}$$

CHAP.

CHAP. XIX.

SUBSTRACTION of FRACTIONS.

I. TO *substract Fractions of different Denominators*, Reduce them to a Common Denominator, and substract the lesser Fraction from the greater.

Examp. From $\frac{3}{4}$ *l.* take $\frac{2}{3}$ *l.* from $\frac{9}{12}$
— — take $\frac{8}{12}$
9 8 —
fa. $\frac{1}{12}$.

II. *If you have a mixt Number, (or Integer and Fraction) and the Fraction to be substracted be greater than the Fraction from which you are to substract.*

Borrow an Integer from the mixt Number, and work as in the Substraction of whole Numbers.

Examp. from $11\frac{2}{3}$—$\frac{12}{8}$
take $2\frac{3}{4}$—9
——————
8——$\frac{11}{12}$

Here I cannot take $\frac{9}{12}$ out of $\frac{8}{12}$, therefore I borrow an Integer, *viz.* 12, and say, 9 out of 12, rest 3, to which add $\frac{8}{12}$, rest $\frac{11}{12}$, and carry 1 to 2 is 3 *l.* out of 11 *l.* rest 8, so the *facit* is $8\frac{11}{12}$.

From	$35\frac{3}{12}$	from	42
take	$19\frac{7}{12}$	take	$16\frac{15}{24}$
facit	$15\frac{8}{12}$	*facit*	$25\frac{9}{24}$

Subtraction of Decimals is the same as in whole Numbers, keeping the place of Unites just under each other.

From

	l.	l.	s.	d.
From	$\frac{7}{8}$,875	the $\frac{7}{8}$ is—	—17	—6
take	$\frac{3}{4}$,75	$\frac{3}{4}$ is—	—15	

l. s.

Reſt ,125 or 2--6 reſt 2—6 equal to the Decimal, 125.

CHAP. XX.

Multiplication of FRACTIONS.

I. TO *Multiply proper Fractions,* Multiply the Numerators together for a new Numerator, and the Denominators Multiply together for a Denominator.

Examp. Multiply $\frac{7}{8}$ by $\frac{3}{4}$, *fa.* $\frac{21}{32}$.

II. *If a mixt Number and a Fraction are to be multiplied together,* Reduce the mixt Number into an improper Fraction, and work as in the laſt.

Ex. Multiply $\underline{11\frac{2}{3}}$ by $\frac{3}{4}$

$\frac{35}{3}$ by $\frac{3}{4}$, *fa.* $\frac{105}{12}$.

l. l.

Ex. Multiply $\underline{11\frac{2}{3}}$ by $\underline{2\frac{3}{4}}$.

l. s. d.

$\frac{35}{3}$ by $\frac{11}{4}$, *fa.* $\frac{385}{12}$, or 32--1--8

III. *To Multiply a mixt Number by an Integer,* Make the Integer an improper Fraction by placing [1] under it, and Reduce your mixt Number into an improper Fraction, and work as in the *firſt Rule.*

Ex. Multiply $\underline{7\frac{5}{8}}$ by 4.

$\frac{61}{8}$ by $\frac{4}{1}$ *fa.* $\frac{244}{8}$.

IV. *Multipli-*

IV. *Multiplication of Decimals* is the same as in whole Numbers, saving as many *Decimal parts* as are in both Multiplicand and Multiplyer, *so many* must be cut off from the Product, which if it have not so many places, the defect must be supplyed with Cyphers towards the left hand.

$$\begin{array}{rr} \text{Multiply} & 11{,}83 \\ \text{by} & \underline{2{,}87} \\ & 82{,}81 \\ & 9464 \\ & \underline{2366} \\ \textit{facit} & 33{,}9521 \end{array}$$

CHAP. XXI.

DIVISION of *FRACTIONS.*

I. TO *Divide Single Fractions:* Reduce them to a Common Denominator, and Divide the *new* Numerator of the Dividend by the *new* Numerator of the Divisor.

Ex. Divide $\frac{7}{8}$ by $\frac{3}{4}$. $24)28$
$28 \quad 24$ *fa.* $1\frac{4}{24}$

II. If it happens that the Fraction of the *Divisor* be greater than the Fraction of the *Dividend*, after you have Reduced them to a Common Denominator, the *facit* of such Division is a Fraction.

Ex. Divide $\frac{3}{4}$ by $\frac{7}{8}$.
$24 \quad 28$ *fa.* $\frac{24}{28}$.

III. *To Divide an Integer by a Fraction*, Multiply the Integer into the Denominator, and Divide by the Numerator.

Ex.

Ex. Divide 8 by $\frac{5}{6}$.

$$\begin{array}{r} 5)48 \\ \hline \textit{facit}\ 9\frac{3}{5}. \end{array}$$

IV. *To Divide a Fraction by an Integer*, The Numerator is Numerator, and the Integer multiplyed by the Denominator, is Denominator.

Example. Divide $\frac{3}{4}$ by 3,

$$\begin{array}{r} 4 \\ 3 \\ \hline 12 \end{array} \quad \textit{fa.}\ \frac{3}{12}.$$

V. *To Divide a mixt Number by an Integer*, Reduce the mixt Number into an improper Fraction, whose Denominator Multiply by the Integer for your Divisor.

Divide $3\frac{3}{8}$ by 2

$\frac{27}{8}$ by $\frac{2}{1}$

$$\begin{array}{r} 16)27 \\ \hline 1\text{—}\frac{11}{16} \end{array} \quad \textit{fa.}\ 1\frac{11}{16}.$$

VI. *To Divide a mixt Number by a Fraction*, Reduce the mixt Number into an improper Fraction, and work as before.

Example. Divide $3\frac{3}{4}$ by $\frac{4}{7}$

$\frac{15}{4}$ by $\frac{4}{7}$

$$\begin{array}{r} 105 \quad 16)\ 105 \\ \hline 9 \end{array}$$

fa. $6\frac{9}{16}$.

VII. *To Divide an Integer by a mixt Number*, Reduce the mixt Number and Integer into improper Fractions, and proceed as before.

Example.

Example. Divide 5 by $3\frac{3}{5}$

$\frac{5}{1}$ by $\frac{18}{5}$ 18) 25

7

fa. $1\frac{7}{18}$

VIII. *To Divide a mixt Number by a mixt Number,* Reduce them into improper Fractions, and Divide as before.

Example. Divide $3\frac{3}{5}$ by $2\frac{3}{4}$

$\frac{18}{5}$ by $\frac{11}{4}$ 55) 72

fa. $1\frac{17}{55}$ 17

Division of Decimals is the ſame as in whole Numbers, till the work be done. And then uſe the Converſe of the Rule for Multiplication, *Viz.* ſo many *Decimals* as are in the Dividend, ſo many there muſt be in the *Diviſor and Quotient:* And if there be not ſo many, the *Quotient* muſt be ſupplyed with Cyphers towards the left hand.

Example. Divide 33,9521 by 2,87

2,87) 525

2382

fa. 11,83 861

00

See the Converſe in Multiplication of Decimals.

CHAP. XXII.

The Rule of Three in Fractions.

RULE: You muſt Multiply your Second and Third Numbers together, and Divide by your Firſt.

Obſerving

Obſerving the ſame Method as in whole Numbers, *Viz*. That the firſt and third Numbers be of one Name or Denomination.

Ex. If $3\frac{1}{2}$ *d.* buy $\frac{2}{3}$ lb. of *Tobacco*, what ſhall $95\frac{3}{4}$ *l.* buy?

$\frac{7}{2}$ of $\frac{1}{240}$.

l. $\frac{7}{480}$ —— *s.* $\frac{2}{3}$ —— *d.* $95\frac{3}{4}$

4

$\frac{383}{4}$ by $\frac{2}{3}$

$\frac{766}{12}$ *fa.*

Divide $\frac{766}{12}$ by $\frac{7}{480}$

$\frac{7}{84}$, $\frac{766}{2880}$

2880

3360

84) 367680

316

fa. 4377 lb. 648

of Tobacco. 600

12

CHAP. XXIII.

Menſuration of Plain Superficies.

The Menſuration of Plain Superficies (*or* Flat-Meaſure) *ſuch as Board, Glaſs, Wainſcot, Painting, and the like.*

Note 1. THAT in *Superficial Meaſure*, 12 times 12 Inches, being 144 Inches, are the Number of Inches contained in a Square Foot of Superficial Meaſure.

2. That

2 That to ſquare any Number, is to Multiply it in it ſelf, as if you would know how many Square Feet is contained in a Yard ſquare. Multiply 3, the Feet in one Yard by 3, the Product is 9, and ſo many Feet make a Yard ſquare.

Ex. How many ſquare Inches are there in a Yard ſquare?

1 Yard is 3 Feet
12
——
36 Inches
36
——
216
108
——
ſa. 1296 Inches.

General Rule is to Multiply the length by the breadth, the Product is the Content.

Examp. 1. A Board 12 Foot long, and 14 Inches broad, how many ſquare feet?

12
——
144
14
——
576
144
——
144) 2016 Inch.
ſa. 14 feet. 576
——
00

inch. 12 foot
$2\frac{1}{6}$ —— 12
——
ſa. 14 ſqu. feet.

But the beſt way is to take Aliquot Parts for 14 Inches, as you ſee wrought in the laſt Example. And this being the moſt practical and ready way, I ſhall purſue it in all the Variety of Superficial Menſuration that followeth.

Ex. 2. A piece of Wainſcot 24 foot, 9 Inches long, and 11 foot deep, how many ſquare yards?

foot inch.		yd. fo. in.
24—9		8—0—9 long.
11 Mult.		3—2—0 deep.
	Or thus,	
9)272—3		24—2—3
		$1\frac{1}{3}$— 2—2—3
fa. 30-0-8		$1\frac{1}{3}$— 2—2—3
		fa. 30—0—9

Here 24 foot 9 Inches is multiplyed by 11 foot, the height, which makes 272 foot 3 Inches, that divided by 9, gives 30 yards, 8 inches, and $\frac{3}{4}$.

But the eaſieſt and beſt way is to bring the height and length into yards, and then Multiply them as you ſee in the Example following.

Ex. 3. A Painter hath done a Room 98 foot about, and 11 $\frac{1}{2}$ foot high, I demand the Square Yards therein?

	yd. fo. in.	foot
		3)98
	32—2—0	
	3—2—6	32—2 feet
	98—0—0	
$1\frac{1}{3}$	——10—2—8	yds. feet in.
$1\frac{1}{3}$	——10—2—8	Anſ. 125—0—08
$6\frac{1}{2}$	—— 5—1—4	
	fa. 125—0—8	

Examp. 4. A *Glaſier* hath done a pane of Glaſs of 5 Foot, 73 high, and 2 Foot, 54 broad, at 6 *d.* the Foot Square.

Note,

Note, The *Glasiers* foot is divided into 10 parts, and every part into 10 parts more.

```
      5,73
      2,54
    ------
      2292
     2865
    1146
  --------
  14,5542 foot.
```

fa. $14\frac{1}{2}$ or 14,5542

A General Rule to Measure Round or Square Pillars.

Multiply the length by the Circumference for *Round Pillars*:

And for *Square Pillars*, add the four sides or breadth together, and multiply the Total by the length.

Ex. 5. A Painter hath done a Pillar of 6 foot 3 inches Circumference, and 14 foot 9 Inches long, I demand the Square yards of Painting?

```
                    yrd. fo  in.
                     4—2—9 length.
                     2—0—3 circumf.
                   -----------
   inch.             9—2—6
   36—3 1/12         0—1—1 9/12
                   -----------
               fa.  10—1—6 9/12
```

Ex. 6. A Pillar 6 yard 2 foot 5 inches long, and 2 foot 1 inch in breadth each side, how many Square yards?

```
                    yrd. fo. in.
                     6—2—5 length.
                     3—0—0 breadth.
yrd. fo. in.       -----------
 3—0—0 broad.  fa.  20—1—3
```

For *Regular Poligons*, Add all the sides together, and Multiply the Total by the length.

For *Cones*, Multiply half the length by the Circumference.

For *Pyramids*, Add all the breadths at the Base together, and Multiply half the length by the Total.

For *Globes*, Multiply the Area of the Circle by 4, it gives the Content.

CHAP.

CHAP. XXIV.

Mensuration of Solids.

Solids, *such as Stone, Timber,* &c. *are Measured by the* Cubick *or* Solid *foot, now a Cube is a figure like a Dye of 6 equal sides, and a Cubick foot contains* 12 *Inches Square on every side.*

THE *Rule is*, Multiply the length by the breadth, and that Product multiply by the depth, which divide by 1728, the Cubick Inches in a foot Solid.

Ex. A piece of Timber 16 foot long, 14 Inch.broad, and 9 Inches deep, how many Solid feet doth it contain?

12
12
———
144
12
———
1728

16
12
———
192
14
———
768
192
———
2688
9
———
1728) 24192 *fa.* 14 foot
14 6912
———
000

Ex. A Stone 7 foot 3 Inches long, 4 foot 5 Inches broad, and 2 foot 3 inches deep, how many solid foot?

7—3 4—5 2—3
12 12 12
——— ——— ———
87 length 53 27
53 breadth
———
261
435
———
4611
27 deep
———
32277
9222
———
fa. 124497 Cubick Inches.

1728) 124497
fa. 71 3337
solid feet 1609

T

To find how many Inches in length make a foot of Square Timber, Multiply the number of Inches square in it self for Divisor, and make 1728, the Cubical Inch of a foot, your Dividend.

Ex. A piece of Timber 18 Inches square, what length will it require to make a foot solid?

```
      18
      18
     ----
     144
      18
   ------
     324) 1728
   ---------
fa. 5 In. 108
```

Ex. How many Inches in length will make a foot at 12 Inches Square?

```
        12
        12
       ----
       144)  1728
      -----   288
fa. 12 in.  -----
               00
```

CHAP. XXV.

Mensuration of Plank.

A Table shewing how many foot of Plank of all Natures make a Load or Tun of Timber.

50 Foot a Load.

Inch.	foot.	
4 plank	150	make a Load.
3	200	
$2\frac{1}{2}$	240	
2	300	
$1\frac{1}{2}$	400	
1	600	
$\frac{3}{4}$	800	

40 Foot a Tun.

Inch.	
3	which divided by, gives the quantity of feet.
4	
$4\frac{4}{5}$	
6	
8	
12	
16	

Inch.

Inch.		foot.				
4	plank	120		3		
3	——	140		4		
$2\frac{1}{2}$	——	192		$4\frac{4}{5}$		which dividedby,
2	——	240	make a Tun.	6		gives the quantity
$1\frac{1}{2}$	——	320		8		of feet.
1	——	480		12		
$\frac{3}{4}$	——	640		16		

Ex. In 7685 foot of 4 Inch. Plank, how many Load and Foot of Timber?

15|0) 76|5
—— 18|(3) 35 load foot
51 —— — *fa.* 51 $11\frac{2}{3}$
25 $11\frac{2}{3}$ foot.

Ex. 2. In 7685 foot of 3 Inch Plank, how many Tun and Foot of Timber?

16|0) 768|5 Tun Foot
—— 128 —— *fa.* 48—$11\frac{1}{4}$
48 —— $-\frac{1}{4}$ 4)5
0 ——
$1\frac{1}{4}$

The remainder of the Divifion is divided by the third Column, as in the Example above the 7685 foot is divided by 160, the number of Feet that make a Tun of 3 Inch Plank, and 5 remains, which divide by 4, the figure even with it, gives 1 foot $\frac{1}{4}$, fo the *facit* is 48 Tun $1\frac{1}{4}$ foot.

THE END.

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